WATER LILIES

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WATER-LILIES
AND HOW TO GROW THEM

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PLATE I.—WHERE THE WATER-LILY GROWS

The subtle charm of the water garden lies as much in the delicate patchwork of light and shade as in the wonderful colourings of the gorgeous flowers running from dazzling white through lemon, to pink and crimson and the clearest blue

WATER-LILIES
AND HOW TO GROW THEM

With Chapters on the Proper Making of Ponds and the Use of Accessory Plants

By
HENRY S. CONARD and HENRI HUS

ILLUSTRATED

NEW YORK
Doubleday, Page & Company
1907

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PUBLISHERS' NOTE

WATER-LILIES are essentially flowers for the man or woman who revels in magnificent colours, for the hues are not equalled in variety or brilliancy by the flowers of any other plants. Is it any wonder that the water-lilies continue to receive a constantly increasing share of attention from horticulturists in all parts of the world?

Within recent years, so much has been accomplished through the efforts of hybridising and hybridisers, many of whom in America have equalled or even surpassed the results obtained by the famous French and English raisers, to whose efforts, it is true, the modern activity is largely due. But with the more favourable climatic conditions of this country, still more striking productions have been placed before the gardener. There are very few ponds or pools that cannot be adapted as cultural sites for the water-lilies,

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and where such do not exist the possibility of growing some of these most gorgeous flowers is not by any means beyond one's reach, for even in a tub of very moderate dimensions, one or two water-lilies may be easily grown. They have their peculiar interests, too, in the fact that some open by day while others are night-bloomers; some are hardy, while others are tender. And it is in the tender night-bloomers that by far the most resplendent combinations of colours are found.

In the following chapters, an effort has been made to place before the reader in simple terms the relative values of the different varieties in the various groups, so that he can make the choice of the kinds that will suit his conditions without having to indulge in time-consuming and costly experiments. The essential facts of water-lily culture are told in simple terms, together with principles of pond construction and management.

The more cultural chapters of the book (Chapters ii., iii., iv., v., vi., x., xii., xiii., and xiv.) have been supplied chiefly by Mr.

Henri Hus, with the coöperation of the veteran cultivator, Mr. James Gurney, whose association with water-lily growing dates back to the occasion when the giant *Victoria regia* first opened its flowers in cultivation. Mr. Gurney is a pioneer in water-lily culture and his work at the Missouri Botanical Garden, and later at Tower Grove Park, St. Louis, Mo., is well known.

The remaining chapters (Chapters i., vii., viii., ix., and xi.), dealing with the relative merits of the different varieties offered in the trade, are chiefly by Professor Henry S. Conard, who has made a special study of the entire family; he is the author of a monograph on the genus Nymphæa, published by the Carnegie Institution, and is perfectly familiar with the work of the hybridists, having watched the development of many of the crosses made by Mr. Tricker and others.

The lists of water-lilies for special purposes given in Chapter xv. are also chiefly Professor Conard's, into which have been embodied a few suggestions made by Mr. Gurney.

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Where Water Gardens Can Be Made

WATER-LILIES

CHAPTER I

Where Water Gardens Can Be Made

A pond of water-lilies is a possibility for anyone who can give *two square feet* of water surface in a sunny spot, and it should be near at hand so that you can easily see the flowers when they are at their best. All the hardy water-lilies must be enjoyed in the morning or early afternoon; for the flowers close at specific times for each kind, varying from noon to four, or at the latest five, o'clock. The tender kinds fall within two distinct classes, there being both day bloomers and night bloomers.

Half a barrel will make a thoroughly practical "lily-pond" for the smallest garden! Cut this to a depth of eighteen inches, fill two-thirds with a rich, heavy soil, and sink

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so that the bottom is three inches below the level of the ground, for though the leaves and flowers love sunshine, the black ooze in which the roots naturally live is always cool.

But one need not stop here. Only space and inclination limit the number of barrels that may be utilised for this purpose. Arrange them so that the whole will form a figure of irregular outline and leave some space between the individual barrels. These spaces, perhaps a foot to eighteen inches wide, offer situations well suited to the needs of a variety of water-loving plants, such as forget-me-nots, Lysimachia and others, which will form a framework to set off the beauties of the water-lilies.

Not all the barrels need contain water-lilies, however. One or two may be devoted to other plants such as water hyacinths, water poppies and the like, while taller plants, like *Cyperus Papyrus* and nelumbiums tend to relieve the flatness necessarily incident to a water garden. The latter, however, grow quite tall and can be used most effectively in

PLATE II.—THE SMALLEST PRACTICAL WATER-LILY POND

The Chinese pigmy water-lily (*Nymphæa tetragona*) will flourish on two square feet of water surface, and half a kerosene barrel will make a really practical pool for the smallest garden

Was there ever such an odd receptacle for water-lilies? A beer vat sawed in two and cemented outside. A scene in a garden on Nile Street, Hartford, Connecticut.

A zinc tank in which an amateur grows one of the tender, night-blooming species of water-lily. He also grows wild rice, Japan iris, etc., around to give "atmosphere"

PLATE III.—BEER VATS AND ZINC TANKS AS POND SUBSTITUTES

large gardens; and they also look best in masses.

A GARDEN IN A TUB

A very satisfactory water garden was half a kerosene barrel, sunk in the ground at the southwest corner of a house, where a rain pipe from the roof emptied into it. Here the water hyacinth (*Eichhornia speciosa*) grew and flowered, to the delight of all beholders. The tub was nearly full of earth in which the plants anchored themselves by their roots and were able to resist the tremendous floods of water from the roof. All through the summer there was a succession of spikes of big azure flowers, each one with a yellow eye-spot; and the glossy, heart-shaped leaves, with their stout, spongy petioles, were themselves an ornament and a curiosity. More than a tubful of the plants was thinned out during the season. The fault of this garden, aside from its smallness, was the irregularity and violence of the water supply. No other plant, except perhaps a

cattail (Typha), could have stood the strain. A kerosene barrel sawed in half will furnish two tubs, each big enough for one lily. The tubs should be well washed out and soaked for some time in water, in order to remove as much as possible of the oil and the glue which is put on to render the vessel tight. Three or four days to a week will suffice for this.

The difference between a barrel and a brewer's hogshead is but one of degree. The hogshead is about six feet in diameter, and may be bought for about five dollars. This modest expenditure makes us the proud possessors of two ponds, each of which may harbour as many as five or six water-lily plants. These two ponds are, of course, formed from the ends of the hogshead, sawed off to a depth of eighteen inches. Having placed the larger ponds in position, the smaller barrel ends can be arranged in respect to them. The nelumbium and Papyrus barrels must find a place at the back, and where they will not prevent the direct sun-

light from reaching the water-lilies. Taller growing terrestrial plants with bold various-coloured foliage, such as certain varieties of castor bean and cannas, will form an excellent background for the whole.

One great advantage of the barrels for making a water garden is that they are not only successful with hardy nymphæas, but are especially well adapted to the requirements of the tender kinds, because the water, being limited to a small receptacle, attains a higher temperature from the sun heat. Danger of the water becoming stagnant is eliminated when the barrels are flushed once a week with the garden hose, and some arrangement should be made for this.

The successful artificial water garden will conform as nearly as possible to the conditions under which Nature herself constructs lagoons and pools. It is surely common sense that it be placed at the foot of a terrace, not on top; also, let the ground slope down to it on all sides, if possible.

If it is to stand in a broad, sloping plain,

grade down the upper side as much as is necessary to bring the lower side about on the natural level of the ground.

It is essentially artificial to find anything like a long dam or terrace descending from the margin of a pond.

OUTLINES IN RELATION TO SIZE

It does not offend if the small tank takes some conventional shape. A sunken tub is essentially round, and a wooden or iron box will unavoidably be square-cornered. A brick or concrete construction, if not over ten feet long, may be rectangular. But if possible avoid geometry in the garden. A bald circle with a gaping ring of cement between the sod and the water is not a thing of beauty, though ponds of geometrical figure edged with stone coping are effective in formal gardens.

Possibly the best of all is a narrow, curving pool, like the bed of some slow stream. Let it widen out here and there into broad, open

stretches if you wish. At the ends, also, or in shallow pockets on the side, the water may give place to a bog garden. On the north side a thicket of trees and shrubs may come out to the water's edge. But keep the south side clear, so as to admit every available ray from the sun.

TREATMENT OF MARGINS

It is in the treatment of the margin that we make or mar a pond's natural beauty. There is no one way in which native waters always meet the land, but there are some ways in which they never do. Nature never made broad borders of concrete or brick or hewn stone. Therefore avoid these in making a water garden. Rough stone walls are permissible at inlet and outlet only and even here they may be avoided if clayey soil can be had, provided the bank can be made proof against crawfish, which is most important. And in place of stones there will spring up beds of moisture-loving mosses,

liverworts, and smooth sheets of Pellæa, whose delicate fruit-stalks shoot up in the first warm days of spring.

Beside the pond itself a path of gravel will enable us to come close to the water's edge. Now we must bend away from the water and around the bog garden; now we cross it on a stone causeway or rustic bridge.

All around the grass and flowers run right out to the water's edge. This is the essential point, and perfectly easy to attain. The water-tight construction of the bottom of the pond only needs to come up to the height of the desired water level. From this point a grassy bank may be raised as steep and high as one desires. Four to six inches above mean water level is high enough. We can hide the junction of land and water completely by means of water-clover (Marsilia). This curious fern-plant, with leaves like a four-leaved clover, grows equally well in the wet edge of the sod or in the pond to a depth of eighteen inches. In the former

situation the leaves stand up three or four inches, in the latter they float.

THE POND BED

The bed of the pond may be variously made. It must be water-tight, not liable to injury by frost, and of a suitable size and depth. We know one little garden which was made by simply scooping out the earth like the bowl of a spoon and laying in a thick coat of cement — no brick, no stone. Here grew the big red Devon water-lily (*Nymphæa Devoniensis*), Sturtevant's massive pink (*Nymphæa Sturtevantii*), both tender; the white night lotus (*Nymphæa Lotus*), and several hardy varieties, and all with the greatest luxuriance. But, alas, one hard winter frost cracked the cement, the water ran out and all was lost. But, then, no artificial pond can last indefinitely without repairs.

Another water garden amateur had a gorgeous show of water hyacinths, big yellow water poppies, plumes of parrot-feathers,

and water-lilies in pink, yellow and white. This tank was built of a single course of brick carefully laid in cement. The place was excavated to a depth of sixteen inches, and the bottom and walls were covered with a coat of the best Portland cement. Its dimensions were four and a half by six and a half feet. It had a partition near one end coming up nearly to the water level. The larger part contained rich earth to a depth of about six inches for water-lilies and lotus, the smaller was filled with earth and served for bog plants. This, however, is not recommended.

The safest construction, however, is that recommended by Mr. Tricker as follows: "Dig down two feet six inches and lay a wall of brick eight inches thick below, tapering (if desired) to four inches at the top. The bottom is packed with broken stone, and this and the walls are heavily coated with the best cement."

In winter the margins should be protected with litter or leaves. Indeed, it is a good thing to draw off all the water and pack the

tank tightly with dead leaves, piling them several inches deep over the whole. Hardy plants will survive so long as the water does not freeze to the bottom.

As to the depth of the pool; twelve to eighteen inches is all that is absolutely necessary for water-lilies, and eighteen to twenty-four will do for Victoria. The additional depth for Victoria is best arranged by making a pit in the bottom of the pond in which to place its tub. Thus room is given for the development of its gigantic leaves and flowers without greatly increasing either the work of excavation or the volume of water required. It is very desirable to have the water shallow enough for the gardener to walk through it with hip boots, though with ponds of twelve feet width, or less, a plank can be laid across and access to the plants is easy.

UTILIZING NATURAL SPRINGS

It is doubtful whether it is easier to build a pond in a natural waterway, or to make

it from the foundation up. Unless the natural water course can be easily diverted it will usually be better not to use it. For every stream at a distance of a hundred feet or more from its spring head is subject to flooding from heavy rains.

Should a violent current sweep over and among our aquatics it would destroy all the tender plants, break down our lotus, papyrus, and the like, and cover everything around with a thick layer of mud, and the season's hopes would be gone. We shall do best, therefore, to secure a more even supply of water. A good spring will suffice for anything except Victoria and the tender water-lilies. Indeed, south of Philadelphia, spring water will materially help many of the hardy nymphæas to endure the summer heat. Lacking a spring, water may be drawn by a pipe or sluiceway from any near-by stream. The sluice will of course be so arranged by gates or by position of intake, as to avoid the flooding of the pond in case of freshets. But, after all, the easiest plan is to draw the water

from a pipe with a spigot. It is not necessary to maintain a continuous flow and change of water. Just as a balanced aquarium will go for weeks or months without attention, so it is with the pond. It is only requisite to replace the water lost by evaporation and leakage.

WATER LOSS BY EVAPORATION

From a surface of sixteen square feet, about a bucketful of water escapes every day by evaporation and transpiration of the plants. Stagnation is prevented by having a few fish and some submerged plants like Cabomba or Myriophyllum. It is therefore very easy to care for a garden up to six by twelve feet, even with only a bucket to supply water. On the other hand, a large pond fed by a natural stream will often be in danger from floods. Unless the stream be very small in proportion to the lake it will be necessary to have means of diverting it into a culvert or sluice on occasion.

Floating parts of plants have very remarkable powers of accommodation to the depth of the water. Water-lily leaves may be entirely submerged in the evening, and by next morning their stalks will have grown just enough to spread them on the surface again. But on all considerations, it is desirable that the water level should not vary more than four inches at the most; even this amount may bring into view ugly strips of mud or masonry. An outlet of ample size is as necessary as an inlet for the regulation of the water supply. Small ponds on level or gently sloping ground may be allowed to overflow their sodded margins. If fed by a continuous open stream, it may be most artistically led away in a similar manner, either directly, or by a waterfall, or through a bog garden.

THE BOG GARDEN

The bog garden consists merely of very wet ground in which a host of interesting plants flourish. It must, of course, be beside

a pond or along a stream. In spring the brown woolly fronds of cinnamon fern will first show themselves, uncoiling as they rise. The swamp rose-mallow (*Hibiscus moscheutos*) will give a wealth of great white or pink flowers in mid-summer. In autumn blue mists of asters or a yellow glow of coreopsis and dazzling shafts of cardinal flower (*Lobelia cardinalis*) will brighten the spot.

HANDLING CUT FLOWERS

Water-lilies do well as cut flowers if they are properly handled. The flower selected for cutting must be newly opened or just about to open. In nature the life of each bloom is limited to three or four days, but in the house it may keep a day or two longer. Occasionally death seems to overtake the motor centres while the flower is still open, and then it remains several days before the petals wither. The new flower may be recognised by these features: (1) The stamens spread apart at the centre of the flower,

leaving a free passage down to the stigma; (2) the anthers are plump and round and have not yet begun to shed any pollen; (3) the basin-like stigma is filled with liquid excreted from its surface.

The flower stalk is scarcely able to supply the petals with water; the cut flower should be floated in a dish or, if placed in a vase, the vase should be full to the brim with water, the flower projecting as little as possible. When carried from the sunny garden into the house the flower is likely to close, on account of the diminished light, but it will open again next morning as well as if it were outside.

Economical Pond Construction

CHAPTER II

Economical Pond Construction

Ponds built entirely of brickwork or concrete offer certain serious objections. In the first place, their banks cannot be planted. Besides, where the winters are very cold, projecting brick or concrete walls must be protected, and it is only where the ponds form part of a formal plan, that the grey masonry edges, projecting half a foot or more above the ground, are appropriate. As a general rule, a combination of concrete and puddling is to be preferred.

For a brick and cement pond, excavate to a depth of two and one-half feet. The sides are given a circular slope, which forms an angle of about 45° with the perpendicular. After the floor has been thoroughly levelled, bricks are laid and cemented into place. Then the walls are built in the same way.

They must reach to within one foot from the bottom. The whole is finally covered with a one-half-inch finishing coat of cement.

The slope above the brick wall must now be covered with puddled clay, thoroughly pounded into place, allowing the clay generously to overlap the cement. It is not necessary for the puddled clay closely to follow the outlines of the pond; for this combination of brickwork and clay allows of a planting of the edges of the pond and some plants demand more space than others, and some even must be allowed to grow out at will if they are to look acceptable. This is true for the majority of plants used in the water garden, one great charm of which lies in the unforced contour lines. When finished, the pond will be about two feet three inches deep.

A water supply must now be arranged. This can come from a faucet, which is a good deal better than a fountain, since a continual spray is not good for water-lilies and has a tendency to give them a bedraggled appearance.

A low fence, constructed of perforated

In this tank the water-lilies bloom almost continuously. Gladioli, nasturtiums and hollyhocks are planted nearby

The tank is 8 x 4 ft. and was made of concrete. It cost $11.28 all told
(*For details see page* 29)

PLATE IV.—CONCRETE CONSTRUCTION FOR SMALL TANKS

PLATE V.—POOLS ON A HILLSIDE GARDEN

There is no one way in which native waters always meet the land, but there are some ways in which they never do. Nature does not make broad edges of concrete, and the walls should be hidden by vegetation on the banks

pipes and connected with the water system, may surround the pond. This will very effectually flush the pond, but is not necessary since a single faucet through which the water can be turned on from time to time is amply sufficient to remove any scum which may accumulate on the surface of the pond. Of course an overflow, connected with a drain or silt-pit, must be provided. This should be placed in position before the laying of the foundation is begun. A narrow drain pipe will be sufficient for all requirements.

The cost of construction of a 10 x 24 ft. pond of the above character is:

LABOUR	
Excavating, 1 man, 1 day	$ 2.00
Masons, 2 men, 2 days	24.00
MATERIAL	
Brick and cement	$20.00
Clay, piping, etc.	2.00
Total	$48.00

Larger ponds are arranged on the same principle and their cost is greater in proportion.

Ponds entirely made of concrete are adapted to formal gardens only. Their construction on a large scale had best be left to contractors who make a specialty of this sort of work. At the present time, granitoid would most probably be the material selected, reinforced, in the case of large ponds, with steel rods. The cost of construction of a circular pond of this nature and about twenty feet in diameter, would be $200; that of one thirty feet in diameter, about $350. This figure includes all labour, but makes no provision for a heating arrangement which, according to its nature, would cost from $150 to $300.

Should one wish to do all the work oneself, or perhaps engage unskilled labour, the following style of pond can advantageously be adopted. Having decided upon the size and location of the pond, mark the outline and proceed with the excavation; an area of about 240 square feet to a depth of three and one-half feet can be accomplished by one man in one day. Give the sides a slope of 60°.

After the earth has been removed and the bottom levelled, bring in sufficient cinders to make a layer six inches thick, covering with a layer of sifted cinders about one inch thick. Cinders are also banked against the sides to the height of eighteen inches. These cinders must be rammed and rolled till the surface is as smooth as possible. Then put on top of this a layer of granitoid from three to four inches thick. It may be prepared by mixing one part of Portland cement and three parts of finely crushed granite. This must be finished off as smooth as possible. The sides are to be formed with the aid of a wooden mould such as is described subsequently. Afterwards cover the whole with a one-half inch finishing coat composed of equal parts of Portland cement and granitoid siftings. The sides, where not covered by granitoid, are puddled with clay in the way just indicated. The actual process of puddling is described in detail on page 32.

A pond constructed in this manner is perhaps less costly than any other but a puddled

pond. For a pond 10 x 24 ft. the cost would be about as follows:

LABOUR	
Excavating, 1 man, 1 day	$ 2.00
Mixing granitoid, sifting cinders, puddling, etc., 1 man, 1 day	2.00
MATERIAL	
Cement and granite, also clay	30.00
Total	$34.00

A 10 x 24 ft. pond is of course, quite big, and if one is satisfied with something on a smaller scale, say 8 x 4 ft., the cost is reduced considerably.

HOME CONCRETE CONSTRUCTION

In *Country Life in America* Mr. B. G. Foster gives the following account of a small tank of concrete construction:

"With the assistance of a workman who had some knowledge of mixing concrete, I constructed a tank, the area of which at the top is about four by eight feet. The tank is

PLATE VI.—A WATER-LILY POND BEFORE PLANTING

A depth of twelve to eighteen inches is all that is absolutely necessary for the nymphæas, and up to two feet for the Victorias. Make the bottom water-tight by puddling. At the farther end can be seen the drain with two openings

PLATE VII.—FORMAL CONCRETE POOL FOR VICTORIAS AND NYMPHÆAS

The water-lilies are planted in the smaller beds or pockets. The central one, lower and heated, is for the Victoria; the water is filled in gradually as the plant develops

three feet deep, and the walls, six inches thick, incline inward at a slight angle. The bottom is four inches thick, and is, like the walls, constructed of broken stone, sand and Portland cement, the whole having a lining of cement and sand.

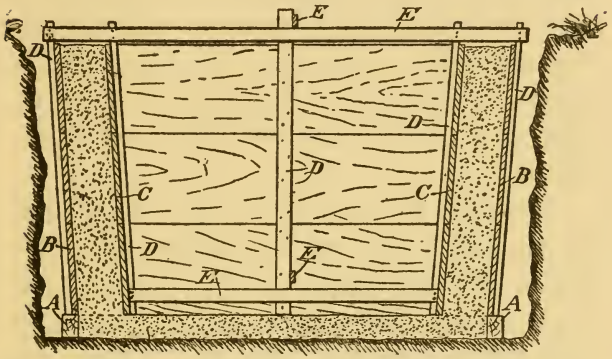
"It being the first of October before the tank was finished, it was allowed to stand over winter, a cover being placed over it to prevent the accumulation of water. In early spring, the bottom was partitioned by boards into four compartments, one foot in depth, which were filled with a rich mixture of well-rotted manure and good soil. In each compartment a lily root was set, and afterward the earth was covered with a thin layer of sand. The tank was then carefully filled with water from the well. But one filling was necessary and the water has never been changed except by rain and evaporation. A few goldfish were introduced to prevent the breeding of mosquitoes and other obnoxious insects

"While awaiting developments I cleared

away the accumulated dirt, sodded the margins around the garden, and permitted the ladies of the household to plant gladioli, nasturtiums and the like in the neighbourhood, while a cluster of hollyhocks at one end served further to break the monotony. The first lily opened fifty-eight days after setting out the plants, and from that time the plants were in almost continual bloom until late in the autumn, as many as twelve blossoms being open at one time.

"The mould used in forming the tank was made of waste lumber and consisted of four parts: a lower bottom-forming frame, a core or inside box, an outside casing or box, and a coping-forming frame. The hole having been dug slightly larger than the finished basin was to be, the bottom frame (A) was first placed therein. This frame, formed of old 2 x 4 scantlings arranged on edge, had inside dimensions equal to the outside dimensions of the bottom of the tank, and after having been placed in position, it was filled level with concrete, thoroughly tamped or packed,

forming the tank bottom. The side-walls were then moulded by means of the outer tapered box (B) and an inner correspondingly shaped box (C), the two boxes being constructed of rough boards joined respectively



Here is a section of the concrete tank showing method of construction. (References in text.)

on their outer and inner sides by upright cleats (D). These boxes had their walls spaced apart a distance equal to the thickness of the walls to be formed, and were placed in position as soon as the bottom frame had been filled. They were fastened to-

gether at the top and properly braced by strips (E) to prevent their springing under pressure, after which the space between them was filled with concrete, thoroughly packed. As soon as the material had sufficiently set, the inner box or core (C), and the top board of the outer box or casing, were removed, leaving the side-walls. The space outside the walls was then filled in and the coping frame was placed in position level with the tops of the walls.

"A lining of sand and cement was applied to the inner faces of the bottom and side-walls, and the coping of the same material was formed upon the latter, the frame (E) constituting a guide in making the same.

"The cost of the tank was as follows:

Labour on construction, 3 days at $1.25	$ 3.75
Labour for breaking stone	2.00
Portland cement, 2½ bbls. at $1.85	4.63
Pipes	.90
	$11.28

"In explanation it may be stated that the

digging of the hole required a full day, as the ground was hard-packed yellow clay, and a ledge of rock was encountered in one end. Moreover, the proportion of sand and cement employed was two to one, whereas a greater proportion of sand might have been employed with success. These increased the cost somewhat.

"The stone was picked up about the place, the sand was obtained in the immediate neighbourhood and, as already stated, waste and discarded lumber was employed, so that these materials, outside of the cost of breaking the stone, added nothing to the expense.

"There is but one change or addition I would suggest to anyone who may construct a water garden along the above lines. This one has a draw-off pipe at the bottom and an overflow pipe at the top. It would be preferable, though not necessary, to have a third outlet from four to six inches below the overflow, to be closed in summer by a suitable plug and to be left open in winter, thus

maintaining a lower level of the water during the cold season of the year."

SIMPLE CLAY PUDDLING

While puddled ponds are the most economical to construct they probably require most in the way of repairs. Besides, they are possible only where the necessary material — a heavy clay — is ready at hand. The first steps of their construction are the same as for all other ponds, at least as far as locating and excavating are concerned; but from there onward the methods of procedure differ. For while both in natural ponds and in ponds built of concrete there is no trouble about their ability to hold water, an artificial pond, where no concrete has been used, must be made water-tight by special means. For such a purpose hydraulic engineering knows of no better material than puddled clay, clay which by a mechanical process has been made homogeneous and very plastic. Unless you absolutely feel the need of exercising your

muscles it is better to get some unskilled labour to do this preparation. For, to reduce even a wheelbarrow load of clay to an absolutely homogeneous mass by working it over and over is no sinecure.

This is the process: Clamp together several boards so as to make a platform, say 6 x 10 ft. Spread the clay, a wheelbarrow load at a time, on the boards, and with a spade, chop it up thoroughly. No lumps larger than a walnut should remain. Remove all sticks, stones etc; then, adding a little water, begin to pound, using a wooden maul and do not stop pounding until a perfectly homogeneous mass, of the consistency of putty, has been obtained. When this is accomplished start on the second load. Happily it is not necessary to use a layer more than four inches thick, so that for a pond twenty feet in length, and with an average width of ten feet, seven to eight wheelbarrow loads of puddled clay will be ample. The cost of this material is generally about five dollars, including hauling, puddling, etc.

Having reduced the clay to the proper consistency, spread it evenly over the bottom of the pond, thoroughly beating it down as laid.

The clay is fairly impervious to water and is not injured by freezing. The margins, from mean water level to a depth of twelve inches, may be lined with stones pounded into the clay. This prevents washing away by ripples or by moving ice. It is also advisable to cover the clay bottom with a few inches of sand so that the puddling may be protected and the mud not so easily stirred up. If this process is carried out consistently, an absolutely water-tight pond will result. The puddling is carried up to within three inches of the rim. Overflow pipes (preferably one pipe with two openings), and a water faucet are to be arranged for beforehand.

When an existing pond is to be converted for the growing of water-lilies, it must be our aim to provide for two things, the outline, and a proper depth of water at all times. The

Notice the grassy margin, instead of concrete; the flowing, graceful outline instead of the unnatural circle or square; and the interesting hardy plants in the border, instead of the everlasting canna, castor oil, ageratum and other bedders

A well planned and properly edged water garden, but too thickly planted: result, few scattering blooms, too solid foliage mass and loss of water effects

PLATE VIII.—ARTISTIC DESIGNS IN ARTIFICIAL PONDS

The high rim of this basin is unnatural. It necessitates bold plantings around to give it a semi-formal setting

Informal basin in the hollow of a lawn. When the stone margin is hidden, such a pond is ideal. Don't overplant

PLATE IX.—HOW TO TREAT A CONCRETE EDGE

outline depends largely on surrounding conditions and no hard and fast rules can be laid down. The water level should be two feet above the bottom of the pond. Ordinarily this will necessitate the construction of a small dam which is easily constructed of grass sods. First empty the pond and then excavate to a depth of four feet where the dam is to be. Then put in the sod. Make the dam four feet wide at the base and at least two and one-half feet wide at the top, and thoroughly cover the sides with puddled clay.

MAKING REPAIRS AND CLEANING

It is often very desirable to drain a pond, in order to repair its walls, to clean it out, or to replant or take in tender species for the winter. Provision should be made for this. Both outlet and drain may be provided as follows: Lead a large (4- or 6-inch) pipe from the deepest part of the pond to some lower outlet—sewer or stream. In the pond attach an elbow joint so as to let the pipe turn

vertically upward. Screw into the joint a piece of pipe just long enough to reach up to the desired water level. Now, when the tank is full, any overflow may go down the pipe and out. To empty the tank, it is necessary to unscrew the upright piece from the elbow. The outlet should in any case be covered with a wire net to prevent clogging of the drain, to retain fish, and to keep floating plants from being lost.

Should the regular outlet be over a waterfall or dam, a large pipe may be laid in the lower part of this wall. A wooden plug at its inner end will close it on ordinary occasions, and can be removed when the pond is to be emptied. From small ponds the water can be dipped or siphoned out.

PREVENTING FLOODS

Where a natural pond is subject to a sudden increase in water volume, a water gate connected with an open ditch or culvert of sufficient size to divert the additional column of

water must be built to obviate damage from floods. This sort of construction work is often complicated and had best be left to professionals, as in the end it will most generally be found a good deal cheaper, and will save much annoyance and disappointment.

If more than one pond is projected, connect them with each other by drains, making each a little lower than the preceding. With such an arrangement, water can be supplied from a fountain in the first pond, which may be entirely ornamental. This has the advantage that the sun's rays heat the water drops in falling. Further, since it is chiefly the surface water which is carried off, the water in the last pond will have the highest temperature. This pond can then be selected for the growing of tender or heat-loving tropical nymphæas, etc. Even the giant *Victoria Cruziana* does well in such an unheated pond in St. Louis, for example, but in more Northern regions, some means of artificial heating would have to be installed to help out.

Soils and Planting Out

CHAPTER III

Soils and Planting Out

One of the most seductive facts about a water garden is that so very little trouble is required to make a good showing. Seedlings of water-lilies are less troublesome to handle than those of even the more common ornamental plants, and they have the further advantage that in planting out there need be no fear of the weather being too hot, or the sun too bright. The one necessary precaution is not to plant too early, but to wait until warm weather is assured. This date will, of course, differ in different sections, and may vary somewhat from year to year, but generally in New York it is about June 15th for the tender kinds; the hardy ones can be set out in May. In St. Louis, a start can be made in April. Planting is done directly in the soil at the bottom of the pond or in

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N. C. Dept of Agriculture.

receptacles, either stationary or movable, according to conditions.

FOR NATURAL PONDS

In natural ponds and in puddled ponds, plant directly; the latter having first of all received a 12- to 15-inch thick layer of soil, consisting of a mixture of three parts heavy loam and one part thoroughly rotted cow manure, well stamped down. Then let in the water, till it stands three inches deep. After a couple of days, when the water has warmed a little, a beginning can be made with planting.

The plants to be put out are either old ones carried over from the previous year, new tubers, or seedlings started indoors in the winter. The work of planting out is simplicity itself. Tubers and root-stocks are laid flat in depressions in the soil made with the hand and are then pressed down. This covers them sufficiently.

Young plants are taken from their pots,

disturbing the soil around the roots as little as possible. Make a hole large enough to accommodate the earthball. Then put the plant in position, pressing down the earth so that a close contact is made between the earthball and the soil. Put the plants three to six feet apart, according to the space the adult ought to occupy, and await results.

Seedlings are treated in a slightly different manner. First of all, do not plant, in one small pond, seedlings mixed with plants raised from tubers and root-stocks. If this is done, the seedlings will simply be overwhelmed, drowned indeed! They require a less depth of water to begin with, and a more gradual increase as the growth develops. If possible, put the seedlings in a special pond, where their needs can receive close attention; but should there be only one pond available, it must be so arranged that one portion is decidedly more shallow, or one of the greenhouse tanks placed out of doors can be used for the young plants.

There is another advantage in this: Among

the hundreds of seedlings obtained from cross-fertilisation (if you are a hybridist) there will be but comparatively few which possess the desired qualities. After the first few flowers have appeared, weed out everything which does not show great promise, unless, of course, needed for some other purpose. Hence unknown seedlings can be planted closer together than others. Three feet between the rows and two feet between the plants in each row is ample.

FOR CONCRETE PONDS

Planting in receptacles, either stationary or movable, is necessary in concrete ponds. If the pond is large enough, stationary tubs, built of the same material as the pond, can be located here and there. They are well adapted to harbour nelumbiums whose root-stocks must be limited by some means if they are to be placed in a pond with other plants, as otherwise they will spread in an alarming manner. Indeed it is by far the

best to avoid this difficulty by giving nelumbiums a pond to themselves.

It is always best to have the ponds built with perfectly plain bottoms, as special receptacles can always be introduced as necessary to accommodate over-vigorous growers. The compartments may be of either brick or wood. When bricks are used, (except for nelumbiums) do not cement them together, but merely build a loose wall by arranging them in alternating layers. The shape of such receptacles will depend upon circumstances, that is to say, on the size and the kind of plant to be introduced and the taste of the builder. Their measurements ordinarily are made to vary from 1 x 2 ft. to 2 x 4 ft. The depth is always the depth of the pond. They will be found best adapted to hardy species of aquatic plants other than lilies, which ought to be set out during the early part of the year, like the water parsnip (*Sium cicutæfolium*), the water poppy (*Limnocharis Humboldtii*), or the various species of Jussieua. A tank 24 feet long and 15 feet broad

can accommodate six or eight of such brick tanks. Besides, such an arrangement leaves the bottom of the pond free. The space thus left can later be filled with boxes in which nymphæas, etc., can be planted according to season.

WHEN TO PLANT

Hardy water-lilies may be planted at any time. If started in early spring they should bloom throughout the summer.

Tender water-lilies must not go out of doors until warm weather is established. A cold storm often occurs in the first ten days of June (in the latitude of Philadelphia), and if it does it will sadly damage or destroy anything tender. Lotuses (Nelumbo) should be planted about the first of May.

Where the pond is very large, or if but one variety of plant is to be grown, the roots may be allowed to run freely in the bottom of the pond. Ordinarily it is much preferable to plant in definite tubs or beds of wood or

A California water garden. Both "tender" and "hardy" water plants do so well, and grow so amazingly that they have to be thinned

This style of pond is proper near buildings. Frankly formal, but adequate for its surroundings, and fitted to the accompanying architecture. Not overplanted

PLATE X.—HARMONIES WITH THE LOCATIONS

A puddled garden, where open water effects are not expected. It resembles a slack water of a meadow, where plants grow thickly

This is an excellent arrangement. The margin is low and unobtrusive. Plenty of sunlight on the water, with heavy background

PLATE XI.—POOLS WITH OPEN SURROUNDINGS

masonry, be they of whatever size or shape. If this is done the strong-growing kinds will not smother out the weak, and those which naturally spread rapidly will stay within proper limits. Lotus rhizomes may run thirty or forty feet in a season if not restricted.

Floating plants, like water hyacinth, must be kept in place by means of floating wooden pens made fast to stakes. The pen, which should be made of inch-square or 1 x 2-inch lumber, will soon be hidden by vegetation.

Loose moveable boxes are satisfactory because they not only allow the gardener to walk through the pond with ease, but they also permit the shifting of the various plants according to their individual needs, thus preventing the plants from becoming crowded. Their use is of course not limited to concrete ponds, for they can be employed equally in deep natural or puddled ponds. Make the boxes at least ten inches deep and two feet square, placing them in position a few days before planting. But in the case of small plants, it will be found better to set the plants

in the boxes before placing the latter in position.

PLANTING IN BASKETS

In natural ponds where the bottoms are too soft to allow one to enter them, planting is accomplished by means of baskets. The tubers or plants are placed in the soil-filled receptacle, which is then lowered into position by means of a rope passed under the handle and held by two men on opposite sides of the pond. The basket soon falls to pieces and the roots easily find their way into the bottom soil. Only hardy species should be set out in such ponds since the roots cannot be recovered in the fall, and tender ones would be lost entirely.

MAKING THE COMPOST

The best soil for use in the boxes or tubs must be a heavy sod-soil mixed with well-rotted cow manure in proportions of three to

one, but a mixture of equal parts good garden soil and well-rotted cow manure makes a good compost also. When setting out the plant spread out the roots well, and after filling in the soil cover with an inch of sand. If old cow manure is not available use ground bone — a small double handful is enough for one small tub. The sand for covering is not a necessity, but it serves to keep in place the earth and manure.

One caution—do not use mud or swamp muck in the water garden; it contains much undecayed matter, which in decomposing causes some portions to float.

After planting, raise the water level to from three to four inches above the crowns of the plants, gradually adding more to keep pace with the growth of the leafstalks, until finally the water level is brought up to from twelve to fifteen inches above the crowns of the plants. It is important that this is done gradually, as the sudden addition of a large amount of cold water is likely to chill and so check the lilies.

Especially in the early part of the season there is liable to be an accumulation of scum largely composed of algæ. A determined effort must be made to get rid of them. An excellent way to accomplish this is, on a warm day, to close all overflows and to allow the water to rise four inches above the highest outlet. Later this can be opened and all algæ will be carried off, especially if a garden hose is called into requisition to clean out the margins and all corners where any growth may have lodged. This matter is further discussed in Chapter xiii.

During the summer little care is required beyond the removal of dead leaves and an occasional flushing, at which time the water level, which may have fallen through evaporation, must be reëstablished.

Wintering and Propagating

CHAPTER IV

Wintering and Propagating

The hardy water-lilies give no trouble in winter as they are simply left outdoors where they grew. They take care of themselves! Natural ponds must perforce remain undisturbed; artificial ponds can have some water drained off, and in places where the winter cold is likely to be very intense, the plants can be covered with planks, hay, leaves or any other protective material ready at hand. Where hardy nymphæas have been grown in tubs plunged in the ground, a simple covering with hay is sufficient. Loose tubs can either be plunged in the ground or removed to a cool cellar. When spring returns, the covering is removed at the same time as it is taken off other garden plants; the tubs can be brought from the cellar in March.

On the other hand, wintering the tender,

day blooming water-lilies is really a difficult matter, requiring some skill and a good deal of space. Full-grown plants may be taken up bodily before frost, either in their tubs, or with a big ball of earth, and wintered in a large, warm tank indoors—there they will keep on blooming, with plenty of heat and light; or will merely keep alive in lower temperatures. Plants which have grown large and flowered, will not live over in any other way, excepting *Nymphæa flavo-virens* and its kin. Usually, therefore, the old plants are left outside to die; but the tubers may be collected.

The night bloomers are wintered more easily than the tender day bloomers. The plants may be taken from the pond either in their tubs, or with a large ball of earth, in October, and allowed to dry off slowly. In a month's time there should remain from each plant one or two small tubers. Sometimes the tuber is smooth and oval; sometimes it is of a very irregular shape. It is kept in dry sand as prescribed for the day

blooming kinds. In February or March the tuber is planted in sand and sunk in a warm tank. Soon it sends out a host of shoots. These mature one by one. They may be broken off and potted separately as soon as they have one or two floating leaves. Each tuber, therefore, of the night blooming water-lilies will produce enough plants to stock a large pond. It is a wise precaution to keep one or two plants in small pots all summer, just to form tubers. The old plants sometimes rot completely when taken in.

Tender nymphæas that are to be carried over the winter for another season must be taken up before there is a chance of a killing frost, that is between October 15th and 30th. If possible, drain the pond of enough water to facilitate the work, removing the leaves from the plants and cutting off the roots about a foot from the centre. Then take up the plants with as much soil as will cling to them.

The best winter quarters for the tender nymphæas is under the bench of a greenhouse with a temperature of from 60° to 65° F.

With the mud clinging to them they show no differences. But most of the stellata type, such as *Nymphæa cærulea*, have a central crown only, while others have one large and a varying number of smaller tubers. These mature during the next month or so, finally going into a dormant condition. Many of the stellata type produce tubers very sparingly and it is often necessary to retain the old rhizome. This old rhizome, however, has a tendency to rot during the winter when placed under the greenhouse bench, to prevent which it must be kept in a growing condition. This is best accomplished by potting it into a 7-inch pot, which is then submerged in a tank in the greenhouse, only a slight covering of water being essential. By the next spring the plant will be found ready to make a vigorous growth.

SORTING OVER THE STOCK

About the middle of January look over the collection to see what can be saved and

what must be thrown away. In this the greatest care must be exercised as many of the most valuable types produce tubers often not larger than a pea.

While sorting the tubers, carefully remove the mud clinging to them, taking care not to injure the eyes. Then place them in rather dry sand, where they can remain till the time comes to start them into growth.

THE SEASON'S OPENING

The new season's work begins about March 1st, when the tubers must be taken from the sand storage and potted up, according to size, in a 3- or 5-inch pot. Use a plain, heavy loam without adding either sand, leaf-soil or manure, but a little sand may be placed on the surface of the soil after potting is done. This will help to keep the plant free from algal growth, and to a certain extent prevent the accumulation of scum on top of the water.

The pots containing the tubers must be

kept in water. For this purpose galvanised iron tanks painted with red lead are best. Tanks of wood may serve, but have a tendency to leak. Besides, they are awkward to handle. Copper tanks do not give good results. A tank six feet long and four feet broad, with a height of about nine inches will be found most serviceable. These can be obtained at a cost of from six to eight dollars. The tanks must be flushed every day or two, to remove any matter which might float on the surface and prove injurious to the young plants.

As soon as a plant gets too big for its pot, shift it into a size larger and continue to do this up to 7-inch pots. Never let a plant suffer from need of shifting. Giving a plant room and the best opportunities in early life, will largely counteract the effects of adverse conditions when it is older. This is a fundamental rule in water-lily growing which never should be lost sight of by the grower. It is all-important.

For various reasons it may be impossible

to obtain seed of some plants. Many of the hardy nymphæas produce it but rarely.

MAKING TUBERS TO PROPAGATE

Many hybrids are practically sterile, and must be propagated from the "roots." The same method may also be used for the true species. Indeed, one can never depend on the purity of seed where several kinds have been grown in the same tank. Natural hybrids are common. For pure stock of tender water-lilies we must commonly have recourse to the following method, beginning a year in advance:

A young plant of the desired kind is kept all summer in a 6-inch pot, in very shallow water. It will make good growth for some time, and then all the leaves will die off. If this does not occur naturally, it must be induced in August or early September, by raising the plant to the surface of the water, or partly out. When the leaves are gone, a tuber the size of a robin's egg should be

found in the pot. Now remove the pot from the water, and let it become nearly dry. Take out the tuber, place it in clean sand, and keep it in a moist, temperate, or warm greenhouse atmosphere until next March. Never let the tuber get hard and desiccated, nor should it get really wet. It needs only a gentle air-drying.

Now, to propagate, set pot and sand and tuber in a warm tank in March. The tuber should be planted about an inch deep. Soon a shoot comes out, sends up leaves to the surface of the water, and makes roots. When one good floating leaf is established, wash away the sand from roots and tuber, carefully break off the shoot with its roots from the apex of the tuber, and replant both plantlet and tuber. Of course the plantlet now goes into rich earth. The tuber should give off at least one more shoot. The first plant is pushed forward for flowering, the next is kept to form a tuber for the following year.

The easiest tender nymphæas to grow, to keep over winter, and to increase from the

tuber, are *N. flavo-virens*, *N. Wm. Stone*, and *N. Mrs. C. W. Ward*. The easiest to grow from seeds are the blue lotus, Zanzibar water-lily, and *Nymphæa flavo-virens*.

WINTERING ENTIRE PLANTS

It may even be necessary to keep the plant itself over the winter. This course is followed in case of seedling water-lilies which, during the year, have not advanced sufficiently to produce either seed or tuber. Though tubers have been formed, they may be immature and likely to decay before the next spring and it then becomes necessary to resort to other methods to retain the variety.

The experienced grower readily foresees which particular plant is liable to be in this undesirable condition in the fall and lays his plans accordingly. As soon as he has decided that the plant is worth keeping— something which usually can be foretold in late summer — he digs it up and repots in a shallow box, five to six inches deep and

about two feet square or even larger. After boxing, the plant is returned to the pond, where it will continue to grow until fall, at which time it can be transported bodily to a tank in the greenhouse. By keeping the water in the tank at ordinary greenhouse temperature, that is to say, 60° to 65° F., growth will not be interrupted, though somewhat retarded, and the tubers have an opportunity to mature. Following this method, it is highly probable that in the spring we will not only have the parent plant but likewise a number of small tubers, which will bloom the same season.

The temperature of the water in these growing tanks should be about the same as that of the house in which they are placed, that is to say, about 65° F. A little more heat is desirable for *Nymphæa Sturtevantii*, and a greenhouse pipe may be passed through the tank to supply the requirement. In an emergency, heating the tank with a coal-oil stove placed under it may be resorted to, but cannot be recommended as a general rule.

Keep the water level so that the edges of the pots are about two inches below the surface. When the leaves appear, keep them just floating, using blocks underneath to regulate the heights of the pots.

Seed Saving and Starting

CHAPTER V

Seed Saving and Starting

Ordinarily nymphæa flowers open and close on from three to five consecutive days, though in the latter part of the season, when the nights get colder, the total time may be prolonged and flowers remain expanded throughout; the day bloomers remaining open all night and the night bloomers remaining open during the daytime. But once the petals of a nymphæa flower have finally closed, the head sinks under water, there to remain, if fertilised, from three to five weeks, during which time the seed develops.

When the capsule is ripe it bursts, and the seed, rising to the surface of the water, is scattered over the pond, where it floats during the ensuing twenty-four hours, and then sinks to the bottom. The floating seed may be gathered with a fine dipnet. But this entails

considerable trouble, and there is no means of knowing exactly which plant yielded the seed just collected.

To prevent the mixing of seed, it is sufficient to tie a cheese-cloth bag over the flower on its last day of blooming. The bag should be tied to a stick stuck in the earth beside the plant, in order to prevent it from being washed away by water currents or carried off by fishes. When the ripe capsule opens, the seed will then be retained in the bag and may readily be gathered. Each plant may carry two or three capsules.

The largest and best seed is that harvested just after mid-summer. Special precautions must be taken in ripening seed of a weak plant. If one such, starting to bloom, shows indications of special merit, and it is desired to save seed from it, the earlier blooms must be sacrificed. Constantly cut off the flower buds as they appear until such a time as the plant has assumed a more vigorous growth, and even then it is wise to allow but a couple of capsules to mature, thus increasing the

food supply of the seed. It is a matter of common observation that well-nourished seed yields the most satisfactory results.

The bagged capsule and seed, after being collected, may remain unopened and, properly labelled, can be put in an open dish in a draughty place away from the direct sun. When all is perfectly dry, place each capsule in a fresh clean bag, keeping it in a convenient place, neither too moist nor too warm, until the seed is wanted for sowing. This rule is to be followed for all nymphæas except those of the Castalia (odorata) group, which must be kept in water in a cool place.

The middle of January — and not before — is the time for sowing seed of all the water-lilies. A house temperature of 65° F. is necessary. Use glazed pans of convenient size, containing about three inches of heavy loam, nothing else. Sprinkle a little sand on the surface to give the young plant a hold. Then fill the pan with water and sprinkle the seed on top. It will float for two or three days and then sink.

In from three to seven weeks the first, threadlike, seed leaves make their appearance. Three to four weeks later the third leaf will have been produced. This is the time to transplant the seedlings. Put them singly in 2-inch pots, shifting later into 3-inch pots and using in both instances a soil composed of heavy loam with which a little most thoroughly rotted cow manure has been mixed. Do not use leafsoil or any other light material. From this time the treatment of seedlings is identical with that of the young plants obtained by vegetative propagation (tubers, or rhizomes), and the whole lot may be grown on together under exactly similar conditions, even in the same tank.

All the true species of tender day-blooming nymphæas seed freely, and may be easily raised from seed. These are *N. gigantea*, *elegans*, *gracilis*, *ampla*, *Capensis*, *Zanzibariensis*, *versicolor*, and *cærulea*. Sow the seeds in February, in small pots or pans, cover them lightly with sand, and keep in warm water, about 80° F. When the plants

have produced three or four leaves each, prick off into separate 3-inch pots, with rich earth, and keep them in warm tanks, with plenty of sunshine. Let them grow as fast as possible, and repot when necessary. Harden off a little in cooler water before setting out. When set out they should have about three leaves, from three to six inches across. Persons who have no accommodations for all this will do best to purchase plants. They are not very costly.

Raising New Varieties

CHAPTER VI

Raising New Varieties

To the thorough-going water-lily enthusiast, hybridising and pedigree-culture, which enable him to trace completely the ancestry of his plants and the influence of the various crosses, are the greatest hobbies.

Where hybridisation has been attempted during the previous season, it is highly probable that some of the seedlings will show the blending of parental characters. Such plants are of course the ones to be chosen for the purpose of propagation, either by seed or from offshoots.

Though the cultivation of water-lilies has attracted widespread attention since the middle of the last century, but very little is known about the limits of variation of the specific characters, and a scientific discussion of the various hybrids (using the word in its

widest sense so as to include both crosses between species and those between varieties) is a subject that the scientific botanist prefers to evade. In the Monograph of the Genus Nymphæa (by Henry S. Conard), published by the Carnegie Institute in 1905, a large number of hybrids whose names have appeared from time to time in various horticultural publications are fully discussed. Too often financial considerations or the fond belief in the undoubted success of an attempted cross have led to the publication of the most high-sounding, frequently most ridiculous, claims. Much regret would have been spared had this fundamental rule of hybridisation been remembered: that by crossing, new characters, *i. e.* characters not existing in the ancestors, can not be produced. The most careful scrutiny of the entire horticultural field shows but few apparent exceptions to this rule and they are often susceptible of other explanation.*

* An example of a wholly new character is the notch in the sinus of the leaf of *N. Robinsoni*. H. S. C.

Without going into details, it may be said that the main object of hybridisation is to combine in the offspring the characters of the parents. This is brought about by the artificial fertilisation of the stigma of a flower of one parent with the pollen obtained from the other parent. Among many water-lily growers the prevailing custom is to dip under water the flower of the intended female parent on the first day of opening, with the intention of removing any pollen which may be present and then shaking over the stigma the ripe contents of the anthers of the flower intended as the male parent. Numerous objections may be urged against this method. Not only is the dipping of the female flower of doubtful necessity but if the operation is successful there is no means of knowing whether the seed which forms is really the result of fertilisation by the pollen selected, or a consequence of fertilisation by the pollen of the female parent itself, or even of pollen carried by insects to the flower on the same or any ensuing day.

If we are to arrive at satisfactory results and wish to save ourselves a large amount of unnecessary trouble incident to the growing of seedlings without value, we must protect ourselves against such contingencies. For this reason, two precautions are taken: the exclusion of insects from the flowers to be used and the removal of the stamens of the female parent. The first object is best arrived at by enclosing the flowers, before they open, in a bag of muslin, which must be finer than mosquito-netting, thus preventing the access of foreign pollen.

Hybridisation must not be attempted in the early part of the summer since but few of the pods mature their seeds then. It is better to wait till August. Almost infertile hybrids, if they mature any pods at all, do so in the latter part of the season only.

Our operations commence by ascertaining if the plant which we desire to cross is capable of producing seed. If the flowers are fertile the presence of a few fertilised ovules is sufficient to influence the movements of the

peduncle which carries the young pod under water and frequently to a comparatively great depth. The manner in which this is done varies in the different groups. If the flowers are not fertile, they are hardly carried below the surface of the water and soon decay, as does the peduncle. Such plants are, of course, to be avoided, unless indeed one wishes to try the influence of a particular kind of pollen in the hope that its use may bring about fertility.

When the water-lily flower opens, the stigmatic cup in the centre is filled with a sweet watery fluid, secreted mainly by the stigma, which is receptive at the time. Not until the second day, after opening, is the pollen ripe and liberated by the splitting of the anthers. Therefore, as fertilisation should take place on the day the flower of the female parent opens, the flower which is to act as male parent (and which must be two days farther advanced) is previously selected and covered by a muslin bag, which should be large enough to allow the enclosed flower to open fully.

On its first day a flower opens about an hour later than on the following days, also closing earlier but opening only half as wide.

On the first day that the flower of the female parent is open, all the stamens must be removed. This requires a little skill and practice. At the same time the stigma can be fertilised with the pollen of the male parent selected 48 hours earlier. After the operation the muslin bag is replaced, to remain indefinitely.

The best way to obtain the pollen is to cut off the flower and take it indoors. After removing the muslin bag, the flower is inverted and the pollen shaken on to a piece of paper. An excellent receptacle for the pollen is a watch-glass with another watch-glass for cover. Or the lid of a porcelain crucible about 1½ to 2 inches wide may be used for this purpose and is very serviceable especially when fastened to a small flat stick such as an 8-inch label. From this the pollen is transferred to the stigma, either by simple shaking or with the aid of a dry camel's-hair brush.

The stigmatic surface, ordinarily yellow in colour, is more or less cup-shaped. The pollen is shaken into the contained fluid, which shortly afterward will be found to have been absorbed and the pollen remains stranded on the papillar surface of the stigma.

If fertilisation is successful the ovary begins to swell within eight days. If unsuccessful, there is no swelling and the flower, remaining near the surface of the water, soon decays. It is well to cut off two or three flowers immediately following the one just fertilised, thus insuring greater supply of food. The seed is harvested and handled subsequently as told in the chapter on "seed saving and starting."

Different results are often obtained by using one species as male and the other as female parent and *vice versa*, for which reason a cross should always be attempted both ways.

While any of the results obtained may be propagated indefinitely in a vegetative manner

it will also pay to raise plants from the seed of one-year-old hybrids, since some of the most experienced growers claim that it is in the second generation that some of the best results appear.

The genealogy of but few of the hybrids now in cultivation can be indicated with any degree of certainty. This is especially the case where the records were in the possession of a single individual who, for trade-reasons, was unwilling to communicate his knowledge. At the same time identical results have been produced at different times and in different countries, and natural hybrids are of common occurrence where closely related species are growing together.

It was about the middle of the nineteenth century that the first attempts at hybridisation were made. The first reputed hybrid, *N. Devoniensis*, was exhibited in England and was claimed to be the result of a cross between *N. rubra* and *N. Lotus*. It is doubtful, however, whether a cross actually took place and now it is generally believed

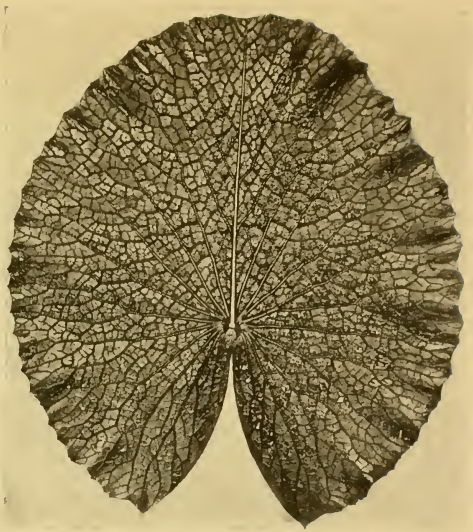
as far more probable that *N. rubra* was self-fertilised.

In 1852 and 1853 hybrids between varieties of *N. Lotus* and *N. rubra*, the latter acting as seed-parent, were obtained in both Belgium and Germany. Much later, in 1885, *N. Lotus* was used as female parent and fertilised with pollen of *N. Devoniensis*. The result was *N. Kewensis*. Though the plant was not propagated, identical plants were later obtained in America where the offspring persists under the same name.

In America much excellent work has been done. Especially the development of the Brachyceras group has received much attention. Though in Germany, in the early sixties, Professor Caspary had devoted much attention to this group, the results obtained were not preserved and it remained for Mr. W. Tricker to originate most of the hybrids now belonging to this group. But the Lotus group also received its share and it is to such men as Gurney, Tricker, Sturtevant, Bissett, Grey and Ames that we are

indebted for the best results. Especially noteworthy in the group are the descendants of *N. Omarana*. This, obtained by Bissett in 1894, is itself a hybrid of complicated parentage. Its direct parents are *N. dentata* and *N. Sturtevantii*. The delicate pink of its flower has gradually been deepened through successive crossings. As an instance of the gradual deepening of colour we may mention a series of crosses carried out by Mr. James Gurney, at Tower Grove Park, St. Louis. In 1902, by crossing a *N. Devoniensis* with *N. Omarana*, he obtained a crimson-flowered plant, very much like *N. Devoniensis* in appearance, which he named *N. Frank Trelease*. He then attempted to introduce the blue colour of *N. Zanzibariensis*, fertilising *N. Frank Trelease* with the pollen of the blue one. In 1905 he obtained a splendid night bloomer which, while possessing the dark-brown foliage of *N. Frank Trelease*, had a dark magenta flower, perceptibly shaded with blue. Continuing the experiment, this plant was again pollenated

The framework of the floating leaves is remarkable. The under sides are often coloured similarly to the flowers. Thus in *N. Zanzibariensis* a purplish blue colour is seen



The leaves of tender water-lilies usually have wavy margins like this (*N. gigantea*). The hardy kinds are always smooth-edged. (A direct sun print)

PLATE XII.—AN INTERESTING STUDY IN MECHANICS

PLATE XIII.—A POND IN A CITY GARDEN

There is unlimited scope in planting the banks and making a setting for the water-lilies. Some sort of a windbreak must be provided, but it must be sufficiently remote to cast no shadow. Water-lilies require sunshine

with *N. Zanzibariensis*, which cross, in 1906, yielded a plant with flowers in which the petals were dark magenta overlaid with bluish purple.*

An immense field of absorbing interest awaits him who with care and patience will devote time to the hybridisation of water-lilies. For as yet we are but at the beginning of things and but little has been done, comparatively speaking.

* Mr. Conard does not admit that a real hybridisation occurs in these cases. These plants and Mr. Sturtevant's *N. tuberosa*, var. *rubra* need minute investigation.

The Hardy Water-lilies

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CHAPTER VII

The Hardy Water-lilies

If one water-lily only can be selected for such a small effort as a two foot square pool, such for instance as might be provided by a half kerosene barrel, the little Chinese pigmy water-lily, *Nymphæa tetragona*, will be the most satisfactory, because it will quickly cover the water with its small horseshoe-shaped leaves. These are dark green, with faint and picturesque brown blotches on the upper surface, dull red beneath, and the combination is rich in colour. Then again, it is a good plant for flowering—a good specimen will keep up a continuous succession of its little star-like flowers throughout the season, from June to September. Often two or three flowers will be open at once. The eight or ten snowy petals surround a group of stout golden stamens, and

in the centre is a broad, yellow, basin-shaped stigma. The flower opens each day about noon and closes again at five in the afternoon, repeating this on three or four successive days. It exhales a delicate fragrance, like that of a tea rose.

If a change from the pure white is wanted we may choose one of the smaller hybrids of the pigmy water-lily. For bright yellow take the yellow pigmy (*Nymphæa tetragona*, var. *helvola*), similar in size and in habit of growth, but the flower is bright yellow and the leaves are very heavily blotched with distinct reddish-brown patches. It gets these characteristics from the native Mexican water-lily (*N. Mexicana*), which is found in Florida, Texas and Mexico. This is a very peculiar species, scarcely hardy as far north as Philadelphia, and certainly cannot be classed as a hardy *garden* plant. For, though it will *exist* in water of a depth of three feet, it will not bloom if left continuously out of doors. It is a shy bloomer even at its best.

For those who prefer pink there is the

Laydeker's pink pigmy (*Nymphæa Laydekeri*, var. *rosea*), another hybrid of the Chinese water-lily. It resembles its Chinese parent in size, habit and character of leaf. The flowers, however, which are produced in great numbers, are more cup-shaped. When the flower first opens the petals are of a delicate shell pink. On subsequent days the inner petals change to rose, and finally to a deep carmine-rose colour; and usually there are two or three flowers of different ages open at once.

These three pigmy varieties are neat enough in all surety, but will only be chosen for a small tank or a Japanese garden, where everything is done on a miniature scale.

FOR GARDENS OF FOUR FEET SQUARE

In the next sized garden, where four feet square or perhaps more can be given to a plant, a very wide choice presents itself. We may now have white, yellow, pink, orange or deep-red flowers, and, whereas

in the very small gardens we have to be content with flowers about two inches, we will now be able to grow some six or eight inches across.

For the smaller spaces, of say two to four feet square, Marliac's yellow (*Nymphæa Marliacea*, var. *chromatella*), the *N. Laydekeri* varieties and *N. exquisita* will do well. But the great majority will not do their best on a water surface less than four feet square.

The first named (chromatella) is decidedly the hardiest and most satisfactory of all the garden water-lilies. It is also one of the oldest, dating from about 1888. The flower is bright yellow, and on its first day sits like a golden cup on the water. It has other very decided claims to favour: A single stock will give a continuous bloom from the first of June until frost, and often there will be two flowers open at once. The leaves usually float on the water, and are beautifully mottled with reddish brown. But in shallow water, or when crowded, both leaves and flowers rise several inches into the free air and grow

The most double of all the white water-lilies (*Nymphæa Richardsoni*). It does best in about three feet of water. The flowers are not odorous

The sweet-scented water-lily has good garden varieties or hybrids. *Nymphæa Luciana* here shown is rosy pink and twice as large as the common white ones

PLATE XIV.—SOME OF THE BEST HARDY KINDS—I

N. Marliacea, var. *rosea*, one of two red French hybrid water-lilies. Both are rank-growing plants, often raising both leaves and flowers above the water

Nymphæa alba, var. *candidissima*, the best of all the water-lilies for deep ponds. One of the early bloomers, and it flowers from June to frost

PLATE XV.—SOME OF THE BEST HARDY KINDS—II

with a look of rank luxuriance. The plant increases rapidly in favourable circumstances, so that the possessor of a single shoot will soon be able to supply his neighbours. It is perfectly hardy, even in water so shallow that it must certainly freeze to the bottom.

The fragrant yellow water-lily (*N. odorata*, var. *sulphurea*) is more delicate, and is easily distinguished when out of flower because the blotched leaves are always floating. The flower is composed of slender spreading petals. Its chief interest lies in the fact that it is the offspring of two native species (*N. odorata* and *N. Mexicana*).

SOME REALLY GOOD WHITE HYBRIDS

Among whites none of the wild species is sufficiently free-flowering to win a place in a small collection. We have, however, some superb varieties. Possibly *N. Gladstoniana* is the best of these. It is thoroughly hardy and a strong grower. The leaves are of a rich green colour, and may reach ten or

twelve inches across. Of the flower what shall be said? Its many snowy petals stand out in all directions, making an airy sphere of glistening whiteness six or eight inches in diameter. The flower opens early in the morning and does not close until two or three o'clock in the afternoon, and often reappears on four successive days. The plant will give a goodly number also from a single shoot in a season, though there must be three or four shoots to insure continuous bloom. The only quality that this water-lily lacks is a sweet scent.

Similar to this in its flower is the white Marliac lily (*N. Marliacea*, var. *albida*), a very rank grower, which often raises its dark-green leaves and flowers well above the water.

A GROUP OF REDS AND ROSES

There are two red-flowered Marliac lilies of identical habit with the preceding, but one (*N. M.*, var *carnea*) has light, pearly, pink

flowers, the other (*N. M.*, var. *rosea*) is deep rose. None of the three can be said to bloom freely. *N. Wm. Doogue* resembles *N. M.*, var. *carnea*, but has larger flowers, sometimes six inches across, and rather more of them. It is of American origin, while all the *N. Marliacea* and *Laydekeri* varieties are French and take their group names from their raisers.

THE CAPE COD WATER-LILY

The flowers have the slender, graceful petals of the common white pond-lily and the delicious scent of that species, but are of a beautiful rose-pink colour. As in the type species the flowers open about 6 A. M. or earlier and close about noon, but this variety has the peculiarity of keeping its sepals continuously open. The closed flower therefore forms an ovate mass of pink, standing on a four-rayed star of dull white. It is a shy bloomer, and must be raised in considerable numbers to give a good effect. It is impatient of the summer heat of Phila-

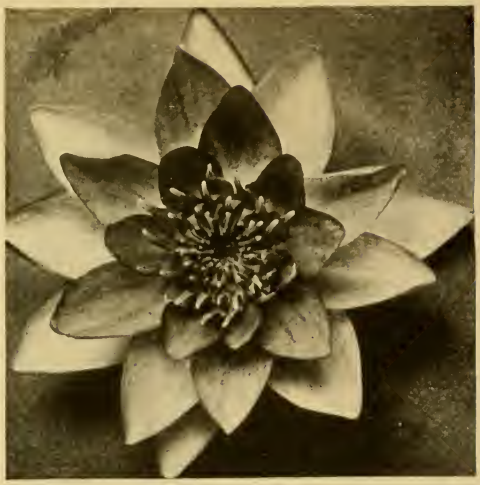
delphia even, but does well in its chief habitat, Cape Cod. One of the Marliac group, called *N. exquisita*, is a more vigorous and more floriferous variety.

THE DEEP RED WATER-LILIES

The flowers of the deep-red varieties are more or less cup-shaped, *i. e.*, the petals are erect and concave. From a pale pink on the outermost petals the colour deepens toward the centre of the flower to a deep crimson. The stamens are crimson or deep orange red on the outer face, with bright-orange or yellow anther cells. In full sunshine the effect is rich and striking. The plants are strong growers for the most part, but slow to propagate. They produce a fine circle of large round leaves and a goodly number of their magnificent blooms, which often reach five or six inches across.

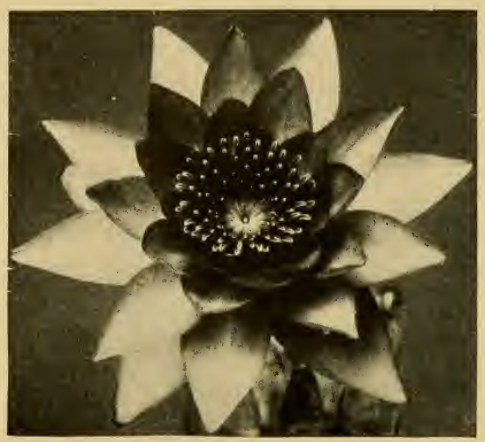
The splendid colouring of this group is derived from the Swedish water-lily (*N. alba*, var. *rubra*), which is very hard to tame. It

N. James Brydon (hardy day-bloomer) has a gorgeous garnet-red flower. Notice the open centre. A young flower



The flower of *N. Aurora* (hardy day-bloomer) opens yellow and gradually becomes redder as it ages. An old flower

PLATE XVI.—WATER-LILIES EVERYONE SHOULD KNOW—I



Nymphæa Robinsoni, one of the yellow-red flowered hardy day-blooming group. The flowers float on the water

N. Jubilee, delicate pinkish white; one of the many hybrids of the night-blooming lotus group. Seeds freely

PLATE XVII.—WATER-LILIES EVERYONE SHOULD KNOW—II

has been grown with tolerable success in northern New York and in Massachusetts, but is not to be recommended. *N. sanguinea* has flowers of rosy, purple-spotted carmine; *Laydekeri purpurata* is rosy crimson with orange-red stamens; *Wm. Falconer*, bright garnet and as much as seven inches across, perhaps the most gorgeous of the lot; *James Gurney*, smaller and dark rose, and *James Brydon* are among the best known of these.

RED AND YELLOW BLENDS

A distinct and beautiful series of varieties in which red and yellow are blended has been produced by combining the Swedish water-lily with our native yellow water-lily (*N. Mexicana*). The effect of the deep red in the centre of the flower with pale yellow on the outer petals is extremely striking. The brown blotching of the leaves which is seen in most of these red-yellow water-lilies is inherited from the American parent. For

small gardens or where one does not want to get off with a minimum of labour these are ideal plants. They do not spread rapidly but maintain a single strong shoot, from which an ample supply of leaves and flowers arises.

N. Robinsoni and *N. Seignoreti* are the oldest and best known of this group. The former bears a peculiar "ear-mark," by which it may always be recognised. As in all the nymphæas, the leaf is round, and attached to the petiole near the centre. On the basal side a deep cleft divides the leaf from the margin, nearly or quite to the petiole. The borders of this cleft are very constantly smooth and entire. But in *N. Robinsoni* there is a peculiar crimped notch on each side, midway of the cleft; it also has floating flowers, whereas those of its companion stand six inches above the water.

The bright combination of yellow, orange and red which characterises the flowers of this group is suggested by the name of one of the most recent members, *N. Aurora*, the

flowers of which, opening with a yellowish colour, get redder and redder as they age.

If you have a large pond there will be room for the less floriferous varieties. The common pond-lily (*N. odorata*), unequalled for sweetness, may be planted. Words cannot picture a large bed of this in full bloom. It is one of those things that one must see to know its beauty and charm. The northern *N. tuberosa* is a more rampant grower, and indeed it will take complete possession of the pond if not opposed. Its flowers are large, pure white, but scentless and few in number. Ample space will also make it well worth while to plant *N. odorata*, var. *rosea*, the pink Cape Cod variety. The fact that it makes few flowers to a shoot is lost sight of in a large pond.

In the shallows *N. odorata*, var. *minor* will do well. It is a diminutive odorata, which can get on fairly well even if the water completely dries away from around it.

Those hitherto mentioned will as a rule give best results in water having a depth of

from one to two feet above the root-stocks; but *N. odorata* and *N. tuberosa*, it is true, will stand three or four feet. But for depths of two to five feet *N. alba*, var. *candidissima* is recommended. Large plants of this will make a wide spread of 10-inch leaves, and will produce splendid white flowers from the first of June until frost. This is one of the earliest bloomers in spring. It is exceedingly strong and hardy.

For depths of water up to eight or ten feet the giant Southern pond-lily (*N. odorata*, var. *gigantea*) is best. It is little more than a large odorata. The leaves reach a foot or more in diameter, the flowers four or five inches.

The following table will aid in identifying any of the hardy kinds.

KEY TO THE HARDY WATER-LILIES

Flowers yellow.
  Opening 11 to 12 A. M.
    Spreading by runners.....*N. Mexicana*
    Without runners.....*N. tetragona*, var. *helvola*

Opening from 7 to 8 A. M.
Petals broad, concave; flower cup-shaped,
N. Marliacea, var *chromatella*
Petals narrow, spreading.....*N. odorata*, var. *sulphurea* and *N. sulphurea*, var. *grandiflora*
Flowers pure white.
Leaves ovate, small.....*N. tetragona*
Leaves circular.
Strongly sweet-scented.
Flowers 2–5 in. across; lvs. 4–8 in.... *N. odorata*
Flowers 1–3 in. across; lvs. 3–5 in. *N. o.*, var. *minor*
Flowers 3–6 in. across; lvs. 8–12 in
N. o., var. *gigantea*
Odourless or nearly so.
Petiole marked with longitudinal brown stripes,
N. tuberosa
Flowers very double. *N. t.*, var. *Richardsonii*
Petiole uniformly coloured.
Sepals rounded to the receptacle.
Always sterile:
Flowers and leaves rising from the water,
N. Marliacea, var. *albida*
Flowers and leaves floating,
N. alba, var. *candidissima*
Fertile; petals spreading in all directions,
N. Gladstoniana
Flower more cup-shaped.....*N. alba*
Very double.....*N. a.*, var. *plenissima*
Very large.....*N. a.*, var. *maxima*
Sepals joining the receptacle by a sharp angle,
N. candida

Flowers red or pink.
Flowers small, pink, opening about 11 A. M.
Plant a single crown without offshoots,
N. Laydekeri, var. *rosea*
Plant with many side shoots,
N. Laydekeri, var. *rosea prolifera*
Flowers 3–7 inches across.
Petals all alike in colour — pink.
Leaves deep red beneath. *N. odorata*, var. *rosea; N. exquisita; N. rosacea*
Leaves pink or green beneath....*N. Caroliniana; N. odorata*, var. *Luciana; N. tuberosa*, var. *rosea; N. t.*, var. *superba*
Outer petals whitish, shading to pink or red at centre of flower.
Plants very robust; fls. and lvs. rising above water.
Flowers soft flesh pink
N. Marliacea, var. *carnea; N. Wm. Doogue*
Flowers deep rose colour.
N. Marliacea, var. *rosea*
Less robust; fls. floating, deep red at centre.
Leaves blotched with brown.
Flowers rosy lilac. *N. Laydekeri*, var. *lilacea*
Flowers deep red.
Sepals and petals in fives.....*N. gloriosa*
Sepals and petals in fours
Stamens deep orange.
N. Marliacea, var. *flammea*
Stamens cardinal
N. Marliacea, var. *ignea*

Leaves dark green.

Fertile.

Inner petals bright red. *N. alba*, var. *rubra*

Inner petals deep carmine. . . . *N. Froebelii*

Sterile hybrids.

Flowers opening in early morning. *N. Wm. Falconer; N. James Gurney; N. James Brydon*

Flowers opening after 9 A. M. *N. Ellisiana; N. sanguinea; N. Marliacea*, var. *rubra punctata; N. Laydekeri*, var. *purpurea*

Outer petals yellowish, shading to red at centre of flower.

Leaf with a notch on border of sinus. *N. Robinsoni.*

Sinus entire. *N. Seignoreti; N. Aurora; N. fulva; N. Andreana; N. lucida; N. Laydekeri fulgens; N. chrysantha; N. Arethusa; N. Arc-en-ciel*

The Tender Day Blooming Water-lilies

CHAPTER VIII

The Tender Day Blooming Water-lilies

There are two great groups of tender water-lilies. In one group the flowers expand in the evening, remain open all night, and close during the following morning (these are discussed in the next chapter); in the other group the flowers open at various hours during the morning, and close, as variously, in the afternoon.

These day bloomers have sweet-scented flowers, six to twelve inches across, carried on strong stalks several inches above the water. The leaves are often very large (up to two feet) and float upon the water like those of the hardy kinds. The leaf margins are often wavy, while the hardy kinds always have smooth-edged leaves. In this group we have — or soon shall have — flowers in all colours: red, blue, yellow, and white! Splendid

creatures they are. It is no wonder the Egyptians carved pictures of them on their temple walls, painted them on their coffins, covered the dead with wreaths of them, and bore them in their processions, as offerings to the gods.

GLISTENING WITH BLUE AND GOLD

The king of all the water-lily tribe is the Zanzibar water-lily (*Nymphæa Zanzibariensis*). Its flowers are of the richest royal blue, often ten inches across, and borne eight or ten inches above the water on strong stalks thicker than one's thumb. The broad, blunt petals make a solid cup-shaped ring, surrounding a large number of stamens. These last are truly "gleaming with purple and gold" — golden anthers, with carmine purple backs. In the centre of the flower, seen only on its first day of opening, is the cup-shaped golden yellow pistil, an inch in diameter. This lily opens on three, four, or rarely five successive days, from 11 A. M. until 5 P. M.

A well-grown plant has dark-green leaves, mottled with brown, eighteen to twenty-four inches across, with deeply wavy margins, and the under side a dull purplish blue.

It will accommodate itself to a great variety of circumstances. It will flower even in a 6-inch pot, sunk in a tub of water, but the blooms will be only three inches across, and the leaves small in proportion. The more room, the more and the larger the flowers and leaves will be. With a 3-foot tub for the roots and ten feet square of water surface, you can get the maximum results.

A new flower comes up every two or three days, so you always have one, often two or three blooms from a single root. It blossoms from the middle of July until killing frosts arrive.

PALE BLUE AND RED ZANZIBARS

There are two forms and several hybrids of the Zanzibar water-lily, all of which

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deserve a close acquaintance: the azure Zanzibar (*N. Zanzibariensis*, var. *azurea*), with flowers of light blue, and leaves pale blue beneath; the pink Zanzibar (*N. Zanzibariensis*, var. *rosea*) which has flowers of bright rose pink, and leaves reddish beneath. There is a tinge of purple about the pink petals of the latter variety, which betrays its origin.

Just how it sprang from its deep blue parent is not quite clear. It makes a massive, beautiful flower.

THE GORGEOUS HYBRIDS

Next to the two just mentioned must be placed the hybrids of similar colour, *N. William Stone*, *Mrs. C. W. Ward*, and *Stella Gurney*. From a broad spreading circle of large green leaves the slender flower stalks rise, topped with graceful, starry blooms.

William Stone is bright blue, Mrs. C. W. Ward is pink, with a tinge of purple, and

Stella Gurney is a very bright pink. In all three, the inside of the sepals shares somewhat of the colour of the petals. They are from seed of the white-flowered *N. flavo-virens* (known in American gardens as *N. gracilis* but different from the plant of that name in Europe). The petals are narrow, and taper to an acute point. The flower is "star-shaped," the parts spreading out in all directions, like rays of a star. They are borne on tall stalks, a foot or more above the water. The effect is very striking.

A RED DERIVED FROM A BLUE

Deserving of special notice is *Nymphæa flavo-virens*, var. *rubra* (The "red gracilis" of our gardens). It is much like Mrs. C. W. Ward, but the purple tone of the latter is eliminated, and we get a pure deep pink, approaching red.

This is at once a pleasure to the cultivator and a notable triumph for the plant breeder,

for it came from a blue parent, *N. Zanzibariensis*.

A GOOD PINK FOR ANYBODY

Another pink water-lily among the tender day bloomers is in this country, though not offered in catalogues. This is *Nymphæa stellata*, var. *versicolor*. The flower is from four to five inches in diameter, pure pink with few and rather narrow petals, rising but a few inches above the water. The leaves have wavy margins, are pink beneath, and about eight inches in diameter. While its size is not equal to that of many of its relatives, this variety is very pretty, and gives promise of value, as one easy to propagate.

In the fall, the base of each leaf, where it separates from the short stem, develops a little, hard tuber. This tuber may be kept along with ordinary tender bulbs during the winter, and will produce one or more plants the following summer. The plant

N. Zanzibariensis, var. *rosea*, the best bright rose water-lily for common use (tender). Open from 11 a. m. to 5 p. m. The type has blue flowers and is equally good.

Nymphæa Pennsylvania, the most prolific tender day-bloomer. Bright blue with a golden centre. Open from 8 a. m. to 5 p. m., at Philadelphia, Pa.

PLATE XVIII.—WATER-LILIES EVERYONE SHOULD KNOW—III

Nymphæa Wm. Stone, one of the easiest of all water-lilies to grow and keeps well over the winter. Bright blue flowers. (*Tender day-blooming*)

N. Devoniensis, the darkest red water-lily. One plant will cover 200 sq. ft. of ground, and have thirty flowers open at one time. (*Tender night-blooming*)

PLATE XIX.—WATER-LILIES EVERYONE SHOULD KNOW—IV

is native to India, Indo-China, and the Philippines.

THE LONGEST ENDURING — GIGANTEA

If for massive, dazzling splendour the Zanzibar water-lily deserves kingly praise, certainly the giant lily (*Nymphæa gigantea*) is the queen of water-lilies. Its flower is a huge, airy head of soft azure blue, with a centre of purest gold. The original specimen in the Kew herbarium is twelve inches across. The blossoms are borne a foot and a half above the water, on slender green stalks, slightly bending with the weight they carry. It is open on five to seven successive days from 8 or 9 A. M. until twilight; it is therefore of much longer duration than any other species. The petals are twenty to fifty in number, broad and rounded, and of a slightly crinkled texture, like crêpe. The colour shades from a deep blue at the point of the petal to a very pale blue at the base. The tints are exquisitely chaste and pure; the

flower is an embodiment of grace and dignity. The leaves are large, a little more oval than round, dark green above, but deep Tyrian purple beneath. The margins are very evenly scalloped, each wave ending in a sharp tooth. The plant is separated from all others of its kind, by several botanical differences, the most notable of which is that there are no gradations from petals to stamens.

Nymphæa gigantea is the most difficult of the day bloomers to cultivate. It can hardly be grown at Philadelphia without artificial heat. If you wish to grow it, get a large plant, and have it shipped in the pot or basket in which it was grown. Set it out two weeks later than the other tender kinds, and hope for warm weather at the time of its arrival. Place it in the tank with the utmost care.

Any check in its growth is likely to cause it to stop growing, and drop its leaves; and it can only be coaxed into growth in warm water after a rest, too late for the current season's

use. The perfect plant is so stately, so noble, that it is worth much effort and risk.

THE ONE POPULAR WHITE

Of blues and whites we may have a considerable assortment, inside the present group. *N. flavo-virens* (commonly catalogued in America as *N. gracilis*), already mentioned, is the only well-known white. Its flowers are borne on tall, slender stalks. The petals open quite widely, and are arranged in a graceful star form. The very sweet-scented flower opens on three successive days from early morning until 5 or 6 P. M. The petals are narrow and pointed, and of a dull rather than a snowy whiteness. The leaves reach a diameter of eighteen to twenty inches, and are bright green on both sides. While this is not a showy species, it is graceful and pleasing.

It is very easily increased, either by seeds or tubers. In the fall the main stem, as big as one's fist, or bigger, hardens and ripens

into a rough tuber. It should be taken indoors about the first of November, or earlier, if ripe, and kept in dry sand. Pringle says he has seen them lying on the ground in dried-up pools in Mexico, like old pine cones. In spring each tuber gives rise to several lusty plants for summer blooming. This hardy character is shared by its offspring, William Stone, Mrs. C. W. Ward and Stella Gurney, making these the best ones for most of us.

THE BEST WHITE NOT OFFERED

A nearly allied species is *Nymphæa ampla*, from tropical America. While it resembles *N. flavo-virens* in colour, the flower is larger (four to seven inches across) and the petals broader, and rounder. The leaf is often very large, twenty to twenty-four inches across, and reddish purple beneath. The sepals are marked with numerous black specks and lines, whereas those of *N. flavo-virens* are pure green, or very rarely with black markings. Unfortunately, this fine

species has yet to be introduced to the American trade; the plant commonly known in the American trade as *N. ampla* is *N. Amazonum*, a night bloomer.

A BLUE GEM FOR THREE DAYS

We have a native blue water-lily which is the daintiest of all its group, *Nymphæa elegans*. The smooth-edged oval leaves lie separately on the water, without crowding one another. They are about eight inches long, by six inches wide, of very graceful outline. The dark green upper surface is handsomely blotched with brown, the under surface a rich red-purple, with blue-black specks. Each flower lasts three days, and is open from 8 A. M. until 1 P. M. Think of the most delicate shade of violet in the rainbow, and you have an idea of the colour that plays on the petals and shades in and out between the golden stamens and the pale sepals of this charming little water-lily. It rarely exceeds six inches in diameter. Like

all the others, it needs no special care in summer, and it is as easy as any blue kind to flower under glass in winter.

THE REAL EGYPTIAN LOTUS

The true Egyptian lotus, or blue lotus (*Nymphæa cærulea*), is a water-lily of this class, and one of the easiest blues to raise. The flowers rise well above the water, and are open for three days, from 7:30 A. M. until noon. They never open very widely, but remain in a broad cup-shape, so that the four green sepals, with the characteristic copious black spots, are always evident. The petals are of a pale-blue colour, shading to dull white at base, not very numerous, and rather narrow. The flowers will measure six and a half inches across, with petals three and a half inches long. The leaves reach a diameter of twenty inches under very favourable circumstances. They are entire, dark green above, copiously spotted with black beneath.

This species produces many seeds, which are easily grown. Its seeds have been known to lie out in the mud of a pond near Philadelphia over two winters, and to come up vigorously during the second summer. The same thing occurred once with the Zanzibar lily, the seedlings actually coming into bloom in September.

OPEN AS LATE AS FOUR O'CLOCK

The last real species of blue water-lily is *Nymphæa Capensis*. It is a strong plant, with pale blue flowers like the azure Zanzibar. It differs from that chiefly in keeping its flowers open from 7 A. M. to 4 P. M., and in having the leaves pure green on both sides. The sepals and petals are narrower. The flowers are very large, and of perfect shape, making this a desirable kind.

THE BEST BLUE STAR

From the blue lotus (*Nymphæa cærulea*) have sprung two hybrids of prominence,

N. pulcherrima and *N. Pennsylvania. N. pulcherrima* has long been known as the best "stellate" light blue. By stellate is meant that the petals are few and narrow enough to give the flower a star-like shape. It is a fairly free bloomer, and produces very large flowers and leaves. Its big, sharp, cone-shaped buds, heavily mottled with black dots, are very striking and characteristic. The leaves have wavy margins.

A DANGEROUS RIVAL — PENNSYLVANIA

It is said, however, that *Nymphæa Pennsylvania* is to outshine *Nymphæa pulcherrima.* Pennsylvania is a most prolific bloomer, always having two or three flowers up at once. They remain open from 8 A. M. until 5 P. M. Each one is a great, bright blue cup, with a golden centre. The buds are big, blunt, and egg-shaped. The four heavy sepals are thickly marked with black dots and lines. The original plant bore petals four and a half inches long. None

of its kin surpasses it in size and freedom of flowering. The leaves, too, are as large as those of any of its allies, spotted with brown above, and more or less bluish beneath.

THE YELLOW GLORIES TO COME

There are two treasures awaiting introduction, and which promise great things. Africa hides in its vast interior two yellow tender species, allied to the present blues and reds and whites. One has excellent double flowers six or seven inches across (*Nymphæa Stuhlmannii*). The other (*Nymphæa sulphurea*) is a pigmy, with flowers and leaves two to three inches in diameter. Aside from their individual attractions, think what a future they offer for hybridisation! It is earnestly hoped that they will not long be absent from our gardens.

KEY TO THE TENDER DAY BLOOMING WATER-LILIES

Colour of flowers white.

Lvs. green beneath; petals acute.....*N. flavo-virens*

Lvs. red-purple beneath; petals obtuse....*N. ampla*

Colour of flowers pink or red.
Lvs. with little wart-like pustules beneath,
N. stellata, var. *versicolor*
Lvs. not pustulate
Petals broad and rounded,
N. Zanzibariensis, var. *rosea*
Petals narrow; flower stellate
Flowers pinkish.....*N. Mrs. C. W. Ward*
Flowers pink.....*N. Stella Gurney*
Flowers red.....*N. flavo-virens*, var. *rubra*
Colour of flowers blue.
Sepals densely marked with black spots
Fl. small; stamens 50 to 70; fertile.....*N. cærulea*
Fl. large; bud sharply conical; sterile,
N. pulcherrima
Fl. large; bud rounded ovoid.....*N. Pennsylvania*
Sepals pure green or with very few spots
The stamens all round-stalked.....*N. gigantea*
The outer stamens with broad flat stalks (filaments)
Lvs. entire; petals delicate violet.....*N. elegans*
Lvs. sinuate, large
Fl. deep royal blue, cup-shaped,
N. Zanzibariensis
Fl. azure blue
Shape stellate; flower stalk tall,
N. Wm. Stone
Shape cup-like; fl. stalk shorter
Lvs. bluish beneath,
N. Zanzibariensis, var. *azurea*
Lvs. pure green beneath...*N. Capensis*

The Night Blooming Water-lilies

CHAPTER IX

The Night Blooming Water-lilies

The night blooming water-lilies, which we may properly term the lotos group, open the flowers between 7 and 8 P. M., and they remain open until from nine to one o'clock of the following day. Each flower does this on three successive nights. These are therefore preëminently the busy man's water-lilies; the proper kinds for the suburban dweller who is away from home and garden throughout the day.

They are all tender. In habit they resemble their day-flowering relatives. The leaves are numerous and mostly large—up to two feet across—and lie flat on the water.

A single plant will cover a space ten or twelve feet square. Yet they get on well in smaller quarters. We know of a red one

that bloomed all one summer in a tank four feet square, where two hardy water-lilies and the water-poppy also shared the space.

The margin of the leaf in all the species of the lotos group is scalloped, with sharply pointed teeth. The flowers, when well grown, are large and massive, and are borne on stout stalks six to twelve inches above the surface of the water. In colour we have all shades, from pure white through pink to magenta and deep red.

A REALLY BEAUTIFUL MAGENTA

The most splendid member of this splendid group is *Nymphæa Omarana*. Its noble flower reaches a diameter of ten or twelve inches.

In colour, it is of a brilliant purple-red hue, close to "magenta" of the colour charts. Each petal has a narrow, nearly white, stripe along the middle. It has, as Tricker says, "an indescribable glow" when seen

in the early morning sunshine. The petals are thin and soft in texture, and spread gracefully in all directions in the fully opened flower. The sepals and lowermost petals become reflexed. The many brownish-red stamens stand erect in a ring at the centre of the flower.

As this kind is a very free bloomer, a single root will always have one or two mature flowers. It begins to bloom in July and continues until frost. The circle of large bronzy-red leaves alone is an ornament to the garden.

Comparable with this is *Nymphæa Sturtevantii*. Under favourable conditions these flowers, too, may reach a foot in diameter. But it never opens more than to a wide cup-shape. The bright pink petals are broad and concave, evenly coloured and very numerous. The incurved stamens are of a brownish orange colour. The bronzy leaves are often very large, and always much crumpled at the margins. It requires plenty of room and a high temperature to give the best

results. It is the most massive in flower and foliage of all the true water-lilies.

THE BEST RED LILY

Of a darker shade than either of the preceding, though a parent of both, is *Nymphæa Devoniensis*. This again has flowers of the largest size, but of a pure red colour. The petals are ovate, four or five inches long by an inch and a half wide. The flower does not expand so widely as that of Omarana, although it is more open than that of Sturtevantii. Devoniensis is a mostly sterile hybrid, and is a very free bloomer. The plant gives rise during the summer to a number of lateral crowns. When several of these get started, a single plant may cover two hundred square feet of pond, and may have as many as thirty-six flowers and buds visible at one time! Under these conditions the leaves are badly crowded, and the flowers are under size, but the effect is superbly rich. When the leaves first come up they are dark red.

As they grow older, they become greener, finally reaching a bronzy-green.

A GROUP OF VERY DARK REDS

Among recent introductions are some reds much deeper in shade than Devoniensis. Probably *N. Geo. Huster* is the best of these. It is a strong grower and free bloomer. Its flowers are not so large as those of Omarana, being only eight to ten inches across at the best. Otherwise the two kinds are much alike.

N. Frank Trelease is a variety with still deeper crimson flowers, of medium size. The colour is so dark as to give very deep shadows between the petals. Its leaves are dark bronzy-red, and about fifteen inches across.

N. James Gurney, Junior (not in the trade) is very much like Frank Trelease, but darker, being dark magenta overlaid by bluish purple.

N. Columbiana, an old variety, is not so deep in colour as the last two, and its flowers are only about six inches across. The leaves are bronzy-red. It is only a moderate grower.

Passing to the other extreme of colour—for colour is our chief means of classifying these kinds — we have several pure whites. The chief of these goes by the name of *Nymphæa dentata*. The petals of dentata are about three and a half times as long as they are wide. In a fully open flower they stand out in a ring or disc exactly at right angles to the petiole. In the middle of the flower the light yellow stamens stand erect. The whole effect is rather curious and a little stiff. It might be likened to a short, stout candle standing in the middle of a white saucer. The leaves are bright green.

As varieties of this there are three forms offered, undoubtedly improvements in size and profusion of flowers: *Nymphæa dentata*, var. *grandiflora*, described as having petals twice as wide as the old form. *N. dentata*, var. *superba* has more numerous petals than the originial, and *N. dentata*, var. *magnifica*, a larger flower. The old dentata only reaches eight or ten inches across.

Distinguished from dentata by the shape of

PLATE XX.—THE FLOWER-BUD OF A VICTORIA

This one (*V. Cruziana*) differs from *V. regia* in being less spiny on the sepals. At the time of opening a delicious fragrance, like pineapples, pervades the air

PLATE XXI.—A SUB-TROPICAL WATER GARDEN

Victoria Cruziana and the Gorgon lily (in the foreground) with tender nymphæas in the rear. The margin has clumps of plants of sub-aquatic nature that lend character

its flower is the white night lotus (*Nymphæa Lotus*). Horticulturally its chief virtue is its great fecundity. Both lotus and dentata bear big balls of seed in great profusion. And their hybrids inherit this character in more or less completeness. The petal of lotus is broad and concave, the outside often tinted with pink. The flower opens only to a cup-shape. *Nymphæa thermalis* is identical with *Nymphæa Lotus*.

From these we may pass to *Jubilee*, of a delicate pinkish white colour, and on to *Smithiana*, with slightly more pink; *delicatissima*, light pink; *Deaniana*, deep pink; *Kewensis*, a little paler than Sturtevantii.

With the flower colour goes a bronzy tint of the leaves. The leaves of delicatissima show a distinct metallic tint, which in Kewensis reaches a definite bronze. In shape of flower, delicatissima resembles dentata: it opens widely, and the petals are narrow. The other three have broad ovate petals, which only open to form a cup-shaped flower.

The cup-shape is only desirable when the

flowers are looked at from above. Ordinarily the widely opening kinds are to be preferred, as water-lilies have generally to be viewed from some distance. And in this group there is no odour to invite a closer inspection.

Only the white night blooming water-lilies can be relied upon to come true to seed. Our reds and pinks are all hybrids, and will produce a great variety of tints from seed. Of course there is a pure red species, *Nymphæa rubra*, from which the hybrids have derived their colour. Regarding this Dr. Conard writes, "in spite of the offerings in catalogues, I am convinced that the true *N. rubra* is not in America. Its home is in India. Will not some one import a pure strain?"

For the curiosity seeker, we must mention here an odd species from South America, the Amazon water-lily (*Nymphæa Amazonum*; known in the trade as *N. ampla*). It needs the same treatment as those just described, though requiring a little more heat. The leaves are bright green, smooth edged, and of

a graceful oval shape. The flower is yellowish white, and four or five inches across. It floats on the water like the hardy kinds. The bud rises just above the water surface to-day, let us suppose. Between 3 and 4 A. M. to-morrow it opens to a narrow cup-shape, and closes again before six. The next day it begins to open about half-past six in the evening, and by eight it has four white petals spread out around a firm white bud. Thus it remains until half-past three in the morning, when the whole flower bursts into full bloom. It thus remains spread for about fifteen minutes; by six o'clock it is entirely closed, and is already retreating into the water. There are several other kinds in South America of unknown, but probably similar, habits. They are only likely to appeal to the night watchman.

THE GIANT VICTORIAS

The queen of all the water-lily tribe, if not of the whole vegetable world, is the wonderful night blooming Victoria. Everyone should

know its gigantic saucer-shaped leaves. They are often six feet across, perfectly circular in outline, with the margin turned up, four to eight inches at right angles to the water surface. Each leaf is a veritable boat, with capacity to float the weight of a man. The under side of the leaf presents a marvellous network of girder-like veins for the support of the giant structure. A strong plant should have three or four such leaves in perfect condition at one time.

The flower is no less remarkable. It floats on the water, and regularly reaches twelve to eighteen inches in diameter. In appearance it is a huge and very double water-lily. The numerous petals are delicate, almost like chiffon in appearance (although really having plenty of substance) and spread out widely in every direction. In spite of its size, there is nothing coarse about it.

Let us watch one open. About four o'clock in the afternoon, the great brown prickly bud looks very forbidding. Soon a most delicious fragrance assails our nostrils;

it speaks of apples, peaches, pineapples — what might be called a "symphony" of scents. We look and see that the pale petals are showing through four crevices in Victoria's bud. As evening advances the great creamy blossom opens fully, and the odour becomes almost oppressive. Next morning, about nine o'clock, the flower closes. The second evening it opens an hour or two earlier than before. It has lost all its scent, but has assumed a pink colour. On the second morning it looks half wilted, and during the day it descends slowly into the water. The Victoria blooms almost continuously after it once gets started. But it requires a long season and a good deal of heat.

Nearly allied to Victoria is the Gorgon plant (*Euryale ferox*), of Indo-China. It has small flowers whose royal blue petals make a brilliant contrast with the red inner surface of the sepals. The flowers, however, are not often seen, and sometimes do not open at all. The leaves are circular, two or three feet across, without any upturned border.

It is cultivated like *Victoria Cruziana*, but is more hardy. These two plants are discussed in greater detail in another chapter.

KEY TO THE TENDER NIGHT BLOOMING WATER-LILIES

Leaves with upturned margins..... *Victoria*
  Sepals smooth above..... *V. Cruziana*
  Sepals prickly to the tip..... *V. regia*
Leaf margins not turned up
  Leaf peltate, entire (not cleft)..... *Euryale ferox*
  Leaf cleft on one side..... *Nymphæa*
    Leaf margin smooth..... *N. Amazonum*
    Leaf margin sharply toothed..... *Lotos group*:—
      Flowers pure white
        Petals spreading flat *N. dentata and varieties*
        Cup-shaped..... *N. Lotus*
      Flowers pink
        Delicate pinkish white; cup-shaped *Jubilee*
        Blush pink; cup-shaped *Smithiana*
        Light pink; opening flat *delicatissima*
        Pure pink; cup-shaped *Deaniana*
        Pink to red; cup-shaped *Kewensis*
        Pink; cup-shaped *Sturtevantii*
      Flowers red
        Magenta; 10–12 in. across *Omarana*
        Red; 6–10 in. across *Devoniensis*
        Red; 6 in. across *Columbiana*
        Deep red; 8–10 in. across *Geo. Huster*
        Crimson; 9–10 in. across *F. Trelease*

The differences between the water-lilies of the Lotos group are too slight to express by an analytic key. We never could do better than to arrange them in a linear series according to the colour of the flower. Indeed, of the hybrid Kewensis it is positively stated that but one plant was raised originally, and it died without leaving any progeny. What we now know as Kewensis, therefore, bears the name only by courtesy. It is a new cross which came out so nearly like its predecessor as to be horticulturally the same.

Growing the Giant Victorias

CHAPTER X

Growing The Giant Victorias

The Victorias or giant water-lilies are natives of the warmer portions of South America, where they thrive in lagoons and in the quieter portions of rivers. Their gigantic leaves, often measuring more than five feet across, as well as the immense flower, fully a foot across, naturally produced a profound impression upon the European botanist Haenke who, in 1801, first reported their discovery. Numerous early attempts to introduce the plant into cultivation in the Old World were unsuccessful; seeds (sent both dry, and packed in wet clay) failed to germinate, and young plants did not survive long enough to produce flowers. It was not until about fifty years after the Victoria became known that the first flowering plants were grown from seed in Europe. At the

Duke of Devonshire's estate at Chatsworth, England, on the eighth day of November, 1849, the first flower opened. During the same year two other plants blossomed in England, the one at Chiswick, the other at the Royal Botanic Gardens, Regent's Park, London. The latter plant was under the care of Mr. James Gurney, the veteran water-lily grower subsequently of Shaw's Garden, at St. Louis, Mo., and now the superintendent of Tower Grove Park in that city where the annual displays of water-lilies have become famous. For him it was a never-to-be-forgotten moment when Queen Victoria, accompanied by the French President, later Napoleon III., came to view the first flowering of the plant that had been named in her honour. A few years later seed was sent to America and the late Thomas Meehan obtained a flowering plant in 1851, in the gardens of Caleb Cope at Springbrook, near Philadelphia, Pa.

At the present time there are recognised two distinct species of these giant water-lilies.

PLATE XXII.—THE GIANT VICTORIA AT ST. LOUIS

Of the two Victorias, *V. Cruziana*, shown here, is the better to grow, requiring less heat than *V. regia* and will even self-sow. The upturned margin is deeper and more even, too. Other differences are given on page 143

PLATE XXIII.—VICTORIA POND BEFORE PLANTING

The sticks indicate the place where pits have been dug to accommodate the special soil for the Victoria. This also shows the system of heating the inner pond. Note the informal margin of stones

One, *Victoria regia*, is a native of the more tropical portion of South America, being found principally in the Amazon region. The other, *Victoria Cruziana*, (the *V. Trickeri* of the trade) occurs in the Rio Parana and its tributaries. This latter situation being comparatively cool, *V. Cruziana* has shown itself far better adapted to outdoor culture than the *V. regia*. Besides this physiological difference there are a number of morphological distinctions. Older plants of the two species may be most readily distinguished by the sepals, which in the regia are spiny almost, or quite, to the tip, while the sepals of Cruziana are smooth, except at the base. Further differences are shown in the leaf colouring.

In the earlier stages, the upper surface of the young leaves of the Cruziana appears bright green and seems to be divided by a network of depressed reddish-coloured veins into a more or less concentric arrangement of quadrangular elevations. This concentric arrangement becomes an apparent radial one

in the young leaves of regia, and their upper surfaces possess a very characteristic reddish-purple colour, except for some thin lines of bright green tissue bordering chiefly the radial veins near the centre of the leaf. In the young leaves of Cruziana this tissue is of a dark red hue.

There are also differences in the under-surfaces of the leaves: those of the young Cruziana being green with an occasional purple tinge, while those of the young regia are a pronounced red-purple. During the later development the leaves of regia have a more robust appearance, though the formation of the upstanding margins begins earlier in the season with Cruziana.

Even in our northern climate both species produce fruit, which, attaining half the size of a man's head, contains numerous seeds, each about the size of a large pea and brownish in colour. These ordinarily retail at twenty-five cents apiece and may be obtained from any reputable seed-house. They are sent out in small glass tubes filled with water.

Keeping the seed very moist, preferably in water of not less than 60° F., is essential to their vitality; and it is to the neglect or ignorance of this little detail that the failures incident to the first attempts to introduce the Victoria must be ascribed. The seed should be procured and sown four months before the time of planting out, that is to say, February first or even earlier. It can be sown at once, using for this purpose a pan or pot three-fourths full of heavy loam, depositing the seeds on top of the soil. The pot must now be placed in a tank in the greenhouse with about three inches of water over the top of the seed bed. Seed of regia requires a temperature of about 85–90° F., to obtain which a device similar to the one used for raising the temperature in the tank in which the seed of tropical nymphæas is germinating, can be used. For the seed of Cruziana so high a temperature is injurious, 60° to 70° F. being sufficient.

Germination may take place in a week or ten days, but the greater number of the seeds

will take at least a month and many may not germinate at all. The first sign of germination is the splitting of the brownish seed-coat from which, shortly, the young root is protruded. In a little while the first thread-like leaf makes its appearance to be followed by a similar one. The third leaf shows an indication of a blade, but is arrow-shaped.

At this stage transplant the seedlings to two-and-one-half to three inch pots, using a heavy loam free from the admixture of sand or leaf-mould, and keeping the plant under water all the time. Repot when the first floating leaf appears and keep on repotting with larger sized pots or pans just as in the case of the nymphæas. Both species are treated in the same way except that throughout *V. Cruziana* requires a temperature 20° F. lower.

Even when 15-inch pans have been used it will often happen that the roots become too numerous for their receptacles and protrude into the water. While this is no cause for worry, it is better in such cases to use

larger pans. Besides this repotting, as they grow, the young Victorias require but little care. It is advisable to keep them clean and free from insects and algal growth. Ordinarily, flushing with a garden hose will meet all requirements, though in extreme cases the use of a bath sponge of fine quality — a so-called Turkish sponge — will have to be resorted to. Should the sun become too strong, which is liable to happen especially during the last days which the plants spend in the greenhouse, shade must be provided, either by whitewashing the glass or by means of cloth or lath frames which can be used during the middle of the day.

If one does not care to take the risks of growing Victorias from seed, young plants can be obtained from the larger horticultural establishments at from $5 to $10 each. Shipped in their own pots and protected by a packing case, they arrive in very fair condition, provided the distance be not too great, a journey of more than three days being liable to produce unfavourable results. On

arrival place the plants in a shaded tank, the water in which has a temperature slightly higher than that prevailing in the interior of the packing case. During the next few days gradually raise the temperature to the normal and the plant will quickly respond. Under these conditions the plants remain till the time of planting.

By the time the plants are about four months old, they will have passed through the stages of their career most fraught with those dangers which we can avert by constant care and watchfulness, and are old enough to shift for themselves. In a climate like that of New Orleans, La., planting out in the pond where they are to grow during the summer is all that is then necessary. In a more temperate region a few extra precautions are yet demanded for Victoria regia, for, though both species may be grown out of doors, only the *V. Cruziana* will do its best in a cool pond. At Philadelphia, for instance, plants of this species may be put outdoors in shallow sunny pools in June. *V. Cruziana* even perfects

seeds, and young plants have been grown from self-sown seeds at Riverton, N. J. They bloomed late in August and September but did not again ripen seed.

For regia, a heated pond, though not absolutely essential, is a desideratum if large leaves and numerous flowers are expected. Seedlings of Cruziana may be planted out, in a climate like that of St. Louis, about May 20th, provided the condition of the weather is favourable. In more northern regions planting out should be delayed for at least two weeks. Such plants should be in bloom by July.

Before planting regia, the ponds prepared according to the directions given elsewhere must be cleaned and levelled. Unless a concrete pit has been provided, special provision must be made for each plant by digging a hole about four feet square and two feet deep and filling in with a mixture of three parts old sod-soil and one part thoroughly rotted cow manure. Four days before planting about six inches of water is let into this

inner pond and at once a beginning is made with heating it to the required temperature by means of the heating plant provided. The temperature should be 80° F. in the morning, while the sun, through the day, may raise it to 90° or even 100° F.

Once this temperature has been acquired by the water and provided the weather is seasonable, a beginning can be made with planting. The greatest care must be exercised in removing the plants from the pots, since the roots must not be injured under any circumstances. If there be any difficulty at all about removing the plant, break the pot — it's a good deal cheaper than a plant. Having successfully removed the Victoria seedling, make a hole in the soil which has been heaped up above the pit and carefully plunge the plant up to the neck in the soil, afterward pressing the soil firmly on the roots. Then a little sand can be strewn over the surface of the compost. This is very helpful in keeping down any vegetable matter which might float and make the surface of the pond

unsightly. If the proper precautions have been taken the plant will thrive.

A little scum will rise to the surface in even the most carefully planted ponds. This must be flushed off. It may happen that two or three days after planting the entire plant and a goodly portion of the soil rises to the surface of the pond! This is invariably due to the fact that the manure used in the compost was insufficiently rotted, and that under the influence of the increased temperature a large amount of gas was generated by the decomposing matter. The only safeguard is the use of the most thoroughly rotted cow manure. Should it occur, there is nothing to do but to repeat the entire operation of planting, the young plant being temporarily returned to its old quarters, care being taken to disturb as little as possible any soil which may be clinging to the roots.

Planting completed, nothing remains to be done other than keeping watch on the temperature and maintaining the water at its proper level. As the plant grows older the

depth of water must be increased. Ordinarily this amounts to about one inch every three or four days. Finally the water-level should be about eighteen inches above the crown of the plant.

If there should be a decided fall in the temperature of the atmosphere during the first few days after planting special arrangements, such as screening, must be made to protect the young plants.

By the end of July the plant will have grown to such an extent that it needs the freedom of the outer pond, as up to this time its growth is confined to the inner tank. The water-level must be raised to such an extent that the inner and outer basin become as one. The heating of the inner basin is continued as before.

The raising of the water level must be as gradual as before. Having raised it first of all an inch above the rim of the inner basin, it is increased till the desired height of the water has been reached, that is to say, about twenty-four inches above the crown of the Victoria.

The seed of the Victoria takes much longer to ripen than does that of nymphæas. For this reason the flower which is to produce it must be selected early in the season. Since those first to appear are not always well formed, it is best not to use them but to wait for, say the fourth flower. Always select a good-sized and perfectly developed blossom for this purpose. On the morning of the third day after opening, surround it with a muslin bag to prevent the possible loss of seed. After this, do not allow other seed pods to develop, for a time at least, cutting all blossoms after their beauty has faded. After about two weeks it will be safe to allow another blossom to perfect a seed pod. The seed will be ripe enough for gathering in ten, or better twelve weeks, after the flower has disappeared under the water and when the flower-stalk begins to decay. But no harm will be done by deferring the harvesting until fall, at the time of the removal of the entire plant for the winter clearance.

Lotuses, Water Hyacinths and Other Choice Aquatics

CHAPTER XI

Lotuses, Water Hyacinths and Other Choice Aquatics

No more stately plants adorn our gardens than the lotuses. Their great, circular, peltate leaves stand three or four feet above the water on stiff, slender, stalks. The leaf is often a little funnel-shaped, so that it catches the rain in a silvery pool at the centre. The surface is never wetted. Then, as the leaves bow before a breath of wind, each empties its cup of water into the pond. The flowers stand as high as, or higher than, the leaves. They are eight to twelve inches across, with many broad petals which stand out in all directions.

The American lotus (*Nelumbo lutea*) is native from New Jersey to Ontario, Minnesota, and Texas. Leaves bigger around than a wash tub and flowers fully ten inches in

diameter may be gathered. The flower is creamy white or of a very pale yellow. It is not a vigorous plant in cultivation, but will do nicely if kept free from competition. It is quickly crowded out by its cousin, the pink or Indian lotus (often and wrongly called Egyptian lotus), *Nelumbo nucifera*, known to dealers as *Nelumbium speciosum*.

The last named species resembles the former in all respects, except colour of flower and vigour of growth. The flowers of the latter are larger than those of the former, and each petal is tipped with rosy pink. At the centre of the flower is a big yellow receptacle like an inverted cone, surrounded by innumerable yellow stamens. These great blossoms are among the noblest products of the vegetable world. They fairly glow in the morning sunshine. In grace, dignity, and repose they are not equalled. No wonder is it that they figure symbolically in the ever-repeated Buddhist prayer, "*Om! mani padme hum!*"— ("O! the jewel in the lotus-flower!")

The pink lotus is perfectly hardy at New York. It once grew in great profusion in a mill dam at Bordentown, N. J., where it was introduced by E. D. Sturtevant. The roots must be protected from freezing by means of litter or a sufficient depth of water.

Several varieties of the pink lotus have been produced in Japan, and are also available here. Rosea has deep rose-coloured petals; there is also a double form of this. Shiroman is a nearly white, very double form. Kinshiren is also very double, and is of medium stature and free flowering. This last kind has been grown successfully in a half barrel. It produced three flowers the first year, but failed to get through the winter alive.

Lotuses grow by long rootstocks, which may run as much as forty feet in a season! They should be planted in very rich earth, under four to twelve inches of water. The bed should be well closed in by boards or a wall. Each year give the bed a good top-dressing of rotted manure. At intervals of three to five years the bed should be dug over

and the plants reset. In autumn each rhizome produces one or more long tubers, much the shape and size of a banana. These are the parts to transplant. They are moved in the spring when they are starting to grow, say about the first of May. Some of the Japanese lotuses are less hardy than others, but none stand the winters as well as the pure species *N. lutea* and *N. nucifera.*

THE STATELIEST AQUATIC "GRASS"

It is no wonder that the plant from which the ancients made their papyrus figured so prominently in Egyptian art, for it is probably the stateliest "grass" in the world. (It is really a sedge.) This Egyptian paper plant (*Cyperus Papyrus*) is known to dealers in greenhouse plants as *Papyrus antiquorum.*

It grows with its roots just submerged, and sends up stalks four to six feet high, with a tuft of fine grass-like leaves a foot long at the top of each stalk. It is like a huge umbrella-plant with extremely fine

PLATE XXIV.—THE PICTURESQUE INDIAN LOTUS

This is the showiest of aquatic-plants other than the water-lilies and the Victoria. The Indian lotus is often miscalled the Egyptian lotus. The roots will sometimes travel forty feet and must be sternly restricted

PLATE XXV.—THE BEAUTIFUL, BUT OVERWHELMING WATER HYACINTHS

Beginning with a few plants, *Eichhornia azurea* multiplies so rapidly that the whole pond is soon covered. But in the fall they all die

leaves. From long association it seems to belong beside the pink lotus. Being tender, it is grown in tubs. In autumn these are taken up after the first frost. The plants may be kept growing in a warm, well-lighted tank, or they may be stored in a cool place, provided they are kept wet. The papyrus needs no season of rest, and produces inconspicuous flowers.

There is a large kind of umbrella-plant (*Cyperus alternifolius*) which grows like the Papyrus and receives the same treatment. It is wholly a foliage plant. The common little umbrella-plant of our houses (*Cyperus alternifolius*, var. *gracilis*) will also do equally well in the water garden. It is very easily propagated by division of the roots, or by planting the "umbrella" part of a leaf, with the stem cut off, in wet earth or in water. There are several varieties of this, differing in stature and in fineness of leaf.

From Florida comes another tall plant, *Thalia divaricata*, which deserves notice. It has broad, oval leaves a foot long. In

character they resemble canna leaves, but they are borne on long stalks two feet above the water. The insignificant flowers come in open panicles on tall wand-like stems. The plant has a loose, easy, picturesque appearance. It grows about six feet tall, and will flourish well in a tub the size of a half barrel. It is wintered in a warm tank, or, half dry, in a cool house.

THE WATER HYACINTHS

Of the plants necessary for the water garden, I should place next to the lotus the water hyacinth (*Eichhornia speciosa*). It makes dense beds of dark green foliage from which project large spikes of rich violet flowers. The plant floats freely on the surface of the water, or the roots will gladly catch in the mud. It will sometimes do equally well in one inch or in two feet of water. The leaves are from three to five inches in diameter, on stalks two to eight inches tall. The floating plants keep themselves up by

making a big swollen air-tissue at the base of each leaf-stalk, while rooted plants have taller and more slender stalks. The spikes are four to eight inches long, with closely set flowers, each two inches or more in diameter. The upper petal is larger than the others and has a bright yellow eye or spot.

The water hyacinth spreads very rapidly, but may be easily kept in place by a floating wooden pen. Nail together some sticks or barrel hoops in the desired size and shape. They will float naturally, but should be fastened to stone anchors or to stakes driven into the bottom of the pond. The plant is tender and must be wintered in a warm tank.

THE BRILLIANT YELLOW WATER POPPY

The next plant which every one should have in his water garden is the water poppy (*Limnocharis Humboldtii*). Plant it in the earth at the edge of the pond, or in a tub supported on stones in the deeper water, so

as to bring the roots near the surface. It sends out copious runners, two or three feet long, on which are many round, dark green leaves, about twice as big as a dollar. Over and among the shiny foliage rise innumerable brilliant yellow flowers as big as the leaves. They look a good deal like California poppies (Eschscholtzia). Each flower lasts only one day, but the succession is never failing. A dozen will often be seen at a time in one corner of a 4-foot tank. The water poppy is tender and must be kept growing throughout the winter in a warm tank.

SOME FASCINATING SUBMERGED PLANTS

Not a little beauty is added to the water garden by wholly, or almost wholly, submerged plants. What is more fascinating than to look down through crystal waters into waving tufts of green and purple foliage fanned by the lithe movements of ornamental fishes? Nearly all submerged leaves are divided into thread-like lobes. So it

is with the cabomba (*C. Caroliniana*). This makes luxuriant green plumes, growing in great bunches one to two feet long. It is hardy in two feet of water at Philadelphia, and grows wild near Washington, D. C. It is the commonest plant sold for aquaria.

The bladderworts are also beautiful for under-water effects, especially the purple one (*Utricularia purpurea*). It grows in big loose tufts, extremely soft and fine. Each leaf bears a number of tiny bladders which catch small insects for the nourishment of the plant. The common bladderwort (*U. vulgaris*) and the inflated bladderwort (*U. inflata*) float freely in the water, usually near or at the surface. They have yellow flowers. All the aquatic bladderworts require very still water, in both summer or winter.

FOR BORDERING PONDS

A good foliage plant for the border and for the decoration of vases and aquaria is

the parrot's feather (*Myriophyllum proserpinacoides*). It grows in slender feathery plumes. The leaves are very many, finely divided, and arranged on all sides of the stem. It grows rooted in earth at the edge of the pond, and spreads out in a broad feathery cushion of bright green. In autumn take in a few sprigs and put the ends in a bottle of water. It will grow all winter like an "air-plant" without earth, but will do better with some soil in the bottle. I know a shallow, sheltered pond of spring water near Philadelphia where it lives out of doors from year to year.

We may also have along the margin of the pond species of Marsilia. It is a water-fern, but does not resemble any other fern. The leaves float or stand erect and look like four-leaved clovers. It is a nice harmless little thing. The European Marsilia (*M. quadrifolia*) is quite hardy in New England.

A really fern-like water-fern is the horn fern (*Ceratopteris thalictroides*). It is well known in European botanical gardens, but is rarely

seen in America. The sterile leaves are divided into many small oval segments, making a feathery light green frond ten or fifteen inches high. When one of these leaves falls over into the water, a young plant springs from every axil and cleft. The fruiting fronds have filiform segments, with revolute margins. The innumerable spores germinate freely in water or on wet earth. It is in this way that new plants are best secured. The plant is naturally an annual, but it may be wintered in a warm tank. Set it out in shallow water (one to four inches deep) after warm weather is established.

Many curiosities may be added to the water garden, some of which also have a real place in the general effect of the garden. The golden club (*Orontium aquaticum*) is interesting for its yellow finger-like blooms, which come out soon after the ice melts. The spotted callas (*Richardia albo-maculata*) may adorn the margin here and there. The native pickerel-weed (*Pontederia cordata*) and the lizard's tail (*Saururus cernuus*), with

flower spikes of blue and white respectively, are useful in some places. On the water's surface the floating moss (*Azolla Caroliniana*), the duckweeds (Lemna), and the salvinia (*S. natans*) are interesting.

Where the lawn dips to the water's edge a clump of swamp rose mallows (*Hibiscus Moscheutos*) will bloom. This is well known as an ordinary garden plant. The great open flowers, white with red centre, or pink, are often five inches across. They bloom very freely through the middle and late summer. Japanese iris, too, in all their multiplicity of splendour, flourish near the margin of the pond.

It would lead us too far to speak of the riches that the borders of the pond will harbour. Only in passing can we glance at two or three nooks beside our way. Here in a little bay a stately group of cat-tails (Typha), narrow-leaved and broad, is waving. Behind them a bushy brake of ferns (Pteris and Woodwardia), willows and the swamp magnolia (*M. glauca*) leads on into the woodland.

This boggy place begins with the common arrow-leaf (*Sagittaria latifolia*). As it wades out into deeper water its leaves are as thin as grass, but they get broad and oval where their stalks are not at all submerged. Among the grasses, and the curious horsetails, rise the stalks of great lobelia (*L. syphilitica*), the cardinal flower (*Lobelia cardinalis*), and their hybrids. What is more brilliant than the spike of the cardinal flower? And beside them stand the aristocratic family of the flowering ferns (Osmunda) — noble ferns of great size and hardiness. Or perhaps in tropical luxuriance beside our *Nymphæa gigantea*, the bog is decorated with banana (*Musa ensete*), the giant rhubarb-like leaves of the Gunnera (*G. manicata* and *G. Chilensis*), shoots of Paulownia (*P. imperialis*), cannas and the like. On yonder rocky promontory a ruddy Japanese maple (*Acer palmatum*, var. *atropurpureum*) hangs over the water, while in crevices of the rock the dainty maidenhair fern (*Adiantum pedatum*) is growing.

Water Gardens Under Glass

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CHAPTER XII

Water Gardens Under Glass

There is no practical difference between growing water-lilies under glass and in the open. Under glass you can begin a little earlier — that is all. Fortunately, in nearly all sections of the country, there is a sufficiently long period of warm summer weather to enable us to grow all the nymphæas, and at least the hardier of the two Victorias, in the open air. In the colder sections, however, it becomes necessary to provide greenhouse protection for the tender species of the former, and perhaps for both the Victorias. Naturally, such houses have to be built with special reference to the purpose, and they are obviously expensive, running into several thousand dollars.

Formerly the circular or octagon shape was looked upon with most favour for the

aquatic house; but lately we have broken away from this tradition. A quadrangular greenhouse is more economical in construction and is really more convenient, as besides the central main pond or tank its form allows for the addition of numerous smaller tanks which can be utilised for the growing of bog-plants, floating aquatics, etc.

The size of the largest houses which exist at the present time is such as to give a floor space of about 4,000 square feet. This is a good size. Water plants never appear to advantage when crowded together in a small space, and moreover they require ample room for their development. They are more sensitive in this regard than terrestrial plants. The Amazon water-lily (*Victoria regia*) is the one species that may call for the special house, and a building in which the width is to the length as 8:13 will be of proper relation, and the smallest tank that should be made for one plant is 20 x 20 feet. The arrangement of the interior requires considerable foresight. Convention places the large Victoria basin in

the centre and smaller basins around the sides. The latter, since they are to accommodate plants of small stature, need be but fifteen inches deep, though it is well to have some thirty inches deep to accommodate Nelumbiums, etc. The central basin has at the sides a depth of thirty inches, and slopes toward the centre, where there is a pit to accommodate the roots of the Victoria. Give this pit a capacity of about two hundred cubic feet.

For heating purposes either steam or hot water can be used, the pipes being made to pass along the edges of both the larger and the smaller basins. The Victoria pit has a special coil, to provide extra heat for the roots and to permit the heating of the small amount of water which must surround the Victoria for the first few days after planting. At first the water temperature must be 90°F. but later, when the plant is well developed, and the tank filled with water, a temperature of 80°F. will suffice. The air, which must be kept at 70°F., should be heated by a pipe passing under the ridge of the roof. Such an

arrangement also greatly facilitates rapid ventilation.

For the water supply there should be at least two taps in the main basin both fitted with a screw attachment for hose connection. Fountains are not to be advocated. They take too much space and the water drops are likely to cause spotting in the Nymphæa blossoms.

For drainage an automatic cone-lid pipe is of greatest advantage. At least two lower holes must be provided so that in the early stages the water level can be kept low, and yet the pond can be flushed. A large drain, to be closed during the summer, is placed at the bottom of the Victoria pond. This enables one to clean the pond thoroughly after the removal of the water plants. Instead of simply running off the water from the tanks into drains it will be found advantageous to allow it to supplement the water in an out-of-door pond or an artificial bog, both intended to accommodate hardier plants and which can be located in the immediate vicinity of the greenhouse. Even the hardier

PLATE XXVI.—AN AQUATIC GARDEN UNDER GLASS

In the North the tender water-lilies must be grown under glass, if a long season of bloom is desired. The red and blue Zanzibar lilies in full flower in Mr. S. Untermeyer's greenhouse at Yonkers, N. Y., on April 26th, long before plants could be put outdoors

PLATE XXVII.—THE WATER-POPPY WITH ITS BRILLIANT YELLOW FLOWERS

For shallow bays along the margin of a pool, or for a small tub-garden, the water-poppy (*Limnocharis Humboldtii*) is the brightest flowering plant. Flowers lemon colour, two and a half inches across

water plants are very grateful for a little extra heat about the roots.

AN EARLY BEGINNING

Planting under glass can be done far earlier than in the open. Even in Apn a beginning can be made, though only with the nymphæas. Since, however, the Victoria is but seldom ready for planting out earlier than the first of May, it is well to wait until then. First plant the Victoria, and when you are sure it has a good start, put in the rest of the water-lilies. Seedlings and also plants raised from tubers and root-stocks that have been wintered, can be started into growth in the side tanks in the growing house.

Concrete walks are better than gravel walks though the latter may present a better appearance. But it is a good deal easier to keep the former clean and dry. Never make the walks too narrow; three feet is a minimum, and in larger houses they can well be double that width. It is very necessary

to arrange for drainage of the walks, especially if of concrete.

For the best type of aquatic house two doors, one at each end, are desirable. One only need be used while the plants are in flower, and should be provided with a vestibule, not only for the protection of visitors from sudden changes of temperature, but also for the protection of the plants themselves from sudden gusts of cold wind. The other door, because it is to be used in the spring for the bringing in of the soil and in the fall for the removal of the old plants, etc., must be at least six feet wide. Though perennial in its native haunts, the Victoria must be treated as an annual when grown in our climate. Attempts to keep the plant a second year have thus far been most unsatisfactory.

During the fall and winter the Victoria house offers an excellent opportunity for the storing of perennials and woody plants, such as crotons, standard fuchsias, lantanas, bay trees, etc., which during the summer have graced the garden.

Enemies and Friends

CHAPTER XIII

Enemies and Friends

Water-lilies growing in natural ponds are greatly subject to the attacks of various enemies, especially of those belonging to the animal kingdom. The one most to be dreaded is the muskrat, who, if unrestrained, will feed on the rhizomes during the winter. He has a preference for those species with the least fibrous roots, such as the odorata group. The nelumbiums also fall a prey to his voracity. And what they use for food is but a small part of what they destroy, for a muskrat, after gnawing off a large piece of the rhizome, will drag it to the bank, there to eat it at his leisure, and leaving it thus exposed it is surely killed.

So great a plague is the muskrat that one has to choose between harbouring this criminal or growing nymphæas. The best

way to get rid of him is by means of traps, though it will pay anyone with many water-lilies to employ the services of a professional trapper. Yet even then a few muskrats may be left or come in from the outside, just when one is reasonably satisfied that the pest has been eliminated. This is especially liable to be the case where the ponds are in the neighbourhood of other natural ponds or of a river. An absolutely safe means of protection against these marauders is to place the roots in large shallow boxes, say three by four feet wide and two feet deep, which are sunk in the proper places. Having filled the boxes with soil the plants are placed in their proper position and wide slats are nailed over the top, at a distance of about two inches from each other. This allows the leaf and flower buds plenty of room to pass through, while it prevents Mr. Muskrat from getting in.

Another enemy to be guarded against, though at a different time of the year, is the snapping turtle, who, delighting in the

young leaves and flower-buds, eats them off nightly. The small mud-turtles, if not numerous, are harmless, though it is well not to let their number increase too greatly. The best method of guarding against them is seining, though a bounty offered to the small boys in the neighbourhood will prove very efficacious.

Sunfish in too great numbers are harmful because they eat the snails which do not harm the older plants and are also beneficial in keeping down the growth of algæ. The latter may become obnoxious in the summer. The best way to get rid of them is by tying a bag of copper sulphate to the end of a boat and rowing up and down the pond, trailing the bag till the salt is entirely dissolved. For this purpose one should use one pound of copper sulphate for every million gallons of water. Where the pond is too small to allow the use of a boat, the salt can be tied in a bag at the end of a stick, which is worked about in the water until the contents are dissolved.

Since the amount of copper sulphate (blue

vitriol) to be used depends upon a number of factors, such as the particular kind of organism to be destroyed, temperature, temporary hardness of the water, etc., the reader had best consult Bulletin No. 76, Bureau of Plant Industry, U. S. Department of Agriculture, in which the method is treated in detail.

In puddled ponds the crawfish may be a source of great annoyance, not only because they cut off the young leaves and even the buds, but also because they bore deep holes through the bottom of the pond, practically turning it into a sieve. Here an ounce of prevention is worth a pound of cure. At the last minute, that is to say, six or seven days before planting, nearly empty the pond. Thousands of crawfish, both young and old will be seen. It is sufficient to sprinkle tobacco dust plentifully. This is effectual in killing all crawfish, and all other animal life, which later may advantageously be replaced by a generous supply of goldfish. In a couple of days flush the pond and empty it once more to clean it out and to repuddle where neces-

sary. If this operation is repeated each year, the crawfish never become a source of serious danger to the well-being of the water garden.

In other artificial ponds none of the above mentioned enemies, algæ perhaps excepted, are liable to become serious. But there are others, particularly those belonging to the insect world, which may cause trouble in any kind of pond. One of these is the leaf-miner, the larva of which channels through the leaf between the upper and lower skins. It may be destroyed by spraying with kerosene emulsion made according to the standard formula. This is best done in the evening after the flowers are closed. Unhappily, the same method cannot be used to combat the leaf-cutter who cuts off portions of the leaves and makes a sort of tent of them, inside of which it moves about. Later in the season, especially, this larva can do much damage. The remedies suggested are lamp-traps and picking off by hand. Dragonflies and frogs are their natural enemies. The latter should be encouraged by every means.

Frequently a fungus attacks the leaves of water-lilies, causing the leaf to become spotted after which it finally decays. A fungicide, such as a very weak Bordeaux mixture, has been recommended to overcome this.

There is quite another fungus that attacks the young seedlings just after they have been transplanted. Here again prevention is better than cure. Strong and healthy seedlings appear to withstand the fungus which seems to be especially prevalent where manure has been mixed with the soil.

The snails which seem so greatly to enjoy their existence in the greenhouse tanks set aside for water-lilies are among the worst pests during the earlier stages of growth. Picking off by hand is perhaps the best remedy though it will be found beneficial to keep a few fish in the tanks. Not only do the fish make war on the snails but they also destroy a large number of the aphides which are found in large numbers on the young plants. Syringing the plants is probably the best remedy.

There are certain water plants which have a tendency to take possession of an entire pond and need keeping within bounds. Such a plant is the water chestnut (*Trapa natans*). Its fruits, provided with strong prongs, lodge in the debris at the bottom of the ponds. Often, in the spring, the entire surface of a large pond will be covered with young plants. Even their removal in boat-loads will not suffice to get rid of the plant which, of comparatively recent introduction, has now become a pest in some localities. Removal does no good as there are always more seeds on the bottom of the pond.

It is inadvisable to use this particular plant, as a cultivated one, in any but concrete ponds, which, at least, can be thoroughly cleaned when the need arises.

During the winter the tubers of the various water-lilies that are stored in the greenhouse, must be carefully protected from the depredations of rats and mice that find them most delectable morsels.

Pond Surroundings, Windbreaks and Accessory Plants

CHAPTER XIV

Pond Surroundings, Windbreaks and Accessory Plants

The aquatic garden must be protected from the wind and, unless some form of windbreak is already in existence, one must be made, especially if the site is near the sea or a lake, or on an open plain. The windbreak also prevents the too rapid evaporation of the water which is likely to be very injurious to plants near the margin.

HEDGES FOR SMALL PONDS

For smaller ponds a low hedge of privet will answer all requirements, but for a large pond, or where there is a series of successive ponds, the windbreaks must be composed of trees, supplemented by groups of shrubbery. In any case the hedge must be placed so that the

ponds are in no way shaded. A distance of at least five hundred yards from the pond is necessary for the windbreaks.

CONIFERS FOR WINDBREAKS

Evergreens form the most important class of windbreaks. Among them, the Norway spruce (*Picea excelsa*) is universally recognised as the best for this purpose. Not only is it perfectly hardy in the northern United States and adapted to almost any soil, but its symmetrical proportions and rapid growth recommend it especially. Provided the trees are trimmed yearly, this spruce can be used equally well as a hedge.

Left to itself, the Norway spruce may attain a height of 150 feet, but long before this, at the age of about thirty years, it will be advisable to replace the trees since they become open at the bottom. There are dwarf varieties to be had.

P. polita, on account of its slow growth, is well adapted to use in small gardens.

Other hardy spruces which make a pleasing appearance, are *P. pungens* and *P. alba*. The latter endures heat and drought very well, differing in this respect from the Sitka spruce (*P. Sitchensis*), and which, though very ornamental, cannot be recommended on this account.

Another evergreen, well adapted for a windbreak, because of its density and symmetry, is the arborvitæ (*Thuya occidentalis*), though in beauty and rapidity of growth it is surpassed by the *Thuya gigantea*. This is not quite hardy in the East, though able to stand the winter on the Atlantic Coast as far north as 43° lat., in which it agrees with the Siberian arborvitæ (*Thuya orientalis*). *T. orientalis* and *T. occidentalis* are readily distinguished by the position of the branchlets; in the former they are arranged perpendicularly, but less so in *T. occidentalis*. The latter tree may become sixty feet high; the former never attains a height of more than twenty-five feet.

Though well adapted for planting singly in

formal gardens, the thuyas give more satisfactory results in hedges or groups.

For light, sandy and well-drained soil, pines form the best windbreaks. Among them the Austrian pine (*Pinus Laricio*, var. *Austriaca*) is especially recommended as it will flourish under the most adverse circumstances and survives in cities where others die from the influence of smoke. It becomes a tree 100 feet high. The Swiss stone pine (*Pinus Cembra*), with a very dense growth and ordinarily attaining a height of seventy feet is quite hardy and very handsome.

The Bhotan pine (*P. excelsa*) is, in a sheltered position, hardy as far north as Massachusetts and may attain a height of 150 feet. It is of special value as a windbreak because it retains its lower branches. The drooping leaves, six to eight inches long, with their blue-grey sheen, make the trees particularly attractive, not only when planted singly but also when grouped.

The Korean pine (*Pinus Koraiensis*), because of its slow growth, is recommended as

a hardy pine for smaller gardens. It may reach a height of 100 feet ultimately.

The mountain white pine (*P. monticola*) is hardy as far north as Massachusetts and may become 100 to 150 feet tall. It resembles the common white pine. The Mountain pine (*P. montana*) with the varieties *pumilio* and *Mughus*, is a hardy, low shrub, suited for planting in clumps or singly. *Pinus parviflora* is not only a very handsome tree, but because of its dense growth it is also very successful as a windbreak. It is quite hardy and reaches a height of about eighty feet. *Pinus Peuce* is hardy and recommends itself by its regular and dense habit; it is, however, of slow growth. The white pine (*Pinus Strobus*) is hardy far north and a rapid grower, reaching a height of from 100 to 150 feet. It is a great favourite because it possesses a very regular habit when young. There are a number of dwarf forms.

The hemlocks constitute quite another class. They are exceedingly graceful trees, not stiff, yet imposing, retaining their lower branches.

They do well almost anywhere provided the soil is not too dry. Ordinarily the native common hemlock (*Tsuga Canadensis*) is used, singly or in groups. It is also well adapted to hedge purposes, but reaches a height of about eighty feet if left alone. Taller and more beautiful, but less hardy, is *Tsuga Mertensiana*, a species of Western North America.

On a moist, well-drained soil, plant the firs. Foremost among them is Nordmann's (*Abies Nordmanniana*), a tree reaching a height of 150 feet and which is much in demand on account of its hardiness and beautiful foliage, dark green and shining above, silvery white on the lower surface. *Abies concolor* takes equal rank with this tree. It is recommended especially for the Eastern States, not only because of its rapid growth and great hardiness but also because it suffers less from heat and drought than do the other firs.

Other desirable firs are *A. Cilicica* and *A. Cephalonica* (of which the variety *Apollinis* is more hardy in the North), *A. homolepis*

Pickerel weed (*Pontederia cordata*) at its best, showing how well this common native looks in cultivation. Flowers pale blue. Needs checking occasionally

Hardy ferns as a border for a shady pond. How much better than the hard, straight shore line that is commonly allowed to show!

PLATE XXVIII.—THE EASIEST MARGIN PLANTINGS

Bur-reeds have interesting, brownish, globular, bur-like heads. For edges of ponds. (*Sparganium eurycarpum*)

A "floating-heart" that resembles the water poppy but has smaller flowers. (*Limnanthemum nymphoides*)

PLATE XXIX.—PLANTS THAT LEND VARIETY TO THE POOL

and *A. Veitchii*, the latter two especially when young.

Some of the cypresses may be used for hedges, particularly the Monterey cypress (*C. macrocarpa*), which, however, is not hardy in the northeast. Cupressus is closely related to Chamæcyparis. The white cedar (*C. sphæroidea*), is a hardy tree, reaching a height of some seventy feet. *C. obtusa*, a Japanese species, becomes much taller but is not as hardy as the Sawara cypress or retinispora (*C. pisifera*). Of the latter two species variegated and dwarf forms exist, all highly ornamental and hardy. Finally the various forms of juniper may be added to the list.

To break the lines of evergreens, deciduous trees are planted.

SHRUBS FOR FOREGROUNDS

As shrubbery in the foreground, the rhododendrons claim first attention. Unfortunately, they do not do well in the warmer, inland regions, being best adapted to moist

atmospheres. Under similar conditions the deciduous azaleas will also grow.

Other shrubs are: Cotoneaster, Cratægus, Daphne, Kalmia, Ptelea. The red osier dogwood for its red bark in winter, and *Ilex verticillata* for its berries are desirable, but be sure to plant both staminate and pistillate trees of the latter.

WHAT PLANTS TO USE

Just what plants to use for the immediate surroundings of the ponds depends somewhat on the size of the latter. For water gardens made of barrels, none but low plants can be employed. Around larger ponds, taller plants find a place. For ponds of large dimensions, bold effects can be aimed at, and indeed the landscape effect of the surroundings must never be lost sight of. Willows, especially the weeping willows, are most appropriate here.

Everyone must be his own judge as far as border planting is concerned, and the following lists of plants (aquatic, swamp, and

terrestrial), include a host from which selections may be made according to fancy:

HARDY SWAMP PLANTS

Sweet flag (*Acorus Calamus*) does well when planted along the borders of ponds. It is perfectly hardy and has splendid yellow blossoms. It may be collected in wet grounds and along streams in the Eastern and Central United States. It has the disadvantage, in common with all other species of Calamus, of having the leaves die at the top after the spring growth. This often necessitates cutting down the whole plant. It reaches a height of from three to four feet. Dwarfer are *A. gramineus* and *A. gramineus*, var. *variegatus*.

Baneberry (*Actæa alba*), whose tall spikes of numerous white flowers show up well against the dark green background of the leaves, is a native of North America and like *A. Japonica* perfectly hardy. Its fruit all summer is also very effective.

Unlike the bamboo, the giant reed (*Arundo Donax*) does not make young growth from the lower portions of the stalks. Hence, though very desirable for its bold effect, it must always be grown with other plants, to hide the bareness of the lower portion of the plant. There exists a variegated form.

The brilliant, red-pink flower of one of the milkweeds (*Asclepias incarnata*) offers, during the early summer months, a bright spot among the green of the border. The plant, however, has the disadvantage of presenting a miserable appearance in the latter part of the season.

One of the most beautiful, hardy swamp-plants is the flowering rush (*Butomus umbellatus*). The flower stem grows as high as three feet and bears pink flowers. The plant likes a wet soil.

The water arum (*Calla palustris*) is quite hardy. It is a dwarf calla with creeping rhizome. On account of the similarity in name it is frequently confused with the marsh marigold (*Caltha palustris*), which, with its

many varieties, will be found quite satisfactory in wet places, especially on account of the brilliant yellow flowers. There is a double flowered variety (*C. palustris*, var. *flore-pleno*) a dwarf form, also double flowered (*C. palustris*, var., *minor flore-pleno*), and a form possessing double flowers larger than the species (*C. palustris*, var., *monstrosus fl.pl.*). Other hardy species of caltha are *C. biflora* and *C. leptosepala*.

There are a number of species of sedge of ornamental appearance. Preferable are *Carex acuta*, var. *albo-variegata* and *C. gallica*, var. *variegata*. *C. plantaginea* is also to be recommended, as are *C. pendula* and *C. riparia*, var. *variegata*.

The button snake root (*Cimicifuga racemosa*) is a close relation of the baneberry and is very similar in appearance.

The water hemlock (*Cicuta maculata*) is a hardy perennial, a native of the United States, and found everywhere along ponds and in marshy places. While tall and graceful and requiring absolutely no care, it must

be remembered that it possesses poisonous properties, as does poison hemlock (*Conium maculatum*), but on account of its foliage which appears very early in spring, it is however to be recommended. Both plants reach a height of six feet or more.

Cyperus longus is a hardy and ornamental swamp plant.

The turtle heads (Chelone) are plants very fond of moist soil and possess white to reddish flowers, blooming in autumn.

The horsetail rushes (Equisetum) are very satisfactory plants for the vicinity of water. Their straight stems form a great contrast with the cotton grass (Eriophorum) a grass whose tall, nodding plumes, are more than graceful. This appearance it has in common with eulalia, of which there exist two variegated forms.

The Pampas grass (*Gynerium argenteum*), with its most graceful plumes, greatly appreciates the neighbourhood of water. This plant, together with its numerous varieties, needs protection during the winter. This,

too, is required by the Gunneras, beautiful foliage plants. Two species are in cultivation, *G. manicata* and *G. scabra.*

Hibiscus yields a number of species which naturally thrive under swamp conditions and are absolutely hardy. *H. militaris*, *H. Moscheutos* and *H. palustris* are the species ordinarily grown. Their large flowers, often ten inches across, are white, or pink, or white with a pink centre. The plants reach a height of four to six feet.

The different species of day lily (Hemerocallis) do excellently under almost any conditions. Once escaped from cultivation they manage to maintain themselves without trouble. The large orange or yellow flowers are very attractive, especially from a distance. There is a variegated variety of *H. fulva.*

Of the numerous species of Iris, the Japanese (*I. lævigata*, or *I. Kæmpferi* of the trade), with numerous varieties, is the most satisfactory. Unfortunately these irises cease blooming by the middle of July. Less beautiful but thoroughly satisfactory is the *Iris*

Pseudacorus, with beautiful yellow flowers. *Iris versicolor*, a swamp-loving plant, with large blue and yellow flowers, may also be used. *Iris Germanica* does not do well in wet soil, preferring a dry situation.

A large number of rushes (Juncus) are ordinarily listed for swamp planting. Especially to be recommended are *J. Holoschœnus*, var. *foliis variegatis* and *J. effusus*, var. *vittatus*. *J. spiralis* has curiously twisted stems.

The cardinal flower (*Lobelia cardinalis*) is one of the most effective plants used in the border of the pond. The tall spikes, loaded with brilliant scarlet flowers, are surpassingly beautiful. It flowers from July to September.

LOW-GROWING PLANTS

Among the low-growing plants, the lysimachias are the favourites for planting immediately adjacent to the water, especially the moneywort (*L. Nummularia*), which when

PLATE XXX.—THE NATIVE WATER-CLOVER

Marsilia quadrifolia, a hardy, native plant that never flowers, is worth growing. It will extend over the swampy soil of the edge, too, effectively hiding the actual line of separation

PLATE XXXI.—BREAKING THE FLAT OUTLINE

Tall reeds, cattails, etc., planted near the edge, break the monotony of a dead water level and make pictures that are quite unlike what are seen in other kinds of gardening

once planted, soon runs over the ground and stones. There is a golden leaved variety. These plants are grown entirely for foliage effect, but *L. clethroides* possesses long spikes of white flowers reaching as high as three feet.

The common loosestrife (*Lythrum Salicaria*) is a plant which, though it will grow under even the most adverse conditions, is very grateful for moisture. It bears numerous tall spikes loaded with whorls of brilliant red flowers. Different shades of red are possessed by its varieties, *atropurpurea* and *rosea superba*.

The water-mint (*Mentha aquatica*) is a low-growing form which, like the American pennyroyal (*Mentha Pulegium*), does excellently on low ground and is to be recommended for use on the edges of ponds.

In the same class is the forget-me-not (*Myosotis palustris*), of which there are several varieties, such as var. *semperflorens*, which blooms throughout the summer, and a fascinated form which bears an exceedingly large

number of flowers. A large-flowered variety is var. *Stabiana*.

TENDER PLANTS FOR BORDERS

For the dryer parts of borders plant bamboos, cannas, hibiscus, and bananas. Tender plants suitable for moist situations are callas and xanthosomas. The beautiful foliage of the latter, with its violet sheen, is particularly attractive. The same is true for the foliage of the *Calathea zebrina;* alocasias and colocasias (to the latter belongs the well-known elephant's ear) are greatly to be desired.

PLANTS TO AVOID

There are two water plants, both hardy, which must be warned against. The one is ditch moss or water weed (*Elodea Canadensis*), which will take possession of a pond unless the most rigorous methods are taken to prevent such a contingency. The other

is the water chesnut (*Trapa natans*). This plant is all right in cement ponds which are cleaned out every year, but its introduction to natural ponds must be strongly advised against. The plant produces numerous fruits which, during the winter remain at the bottom of the pond, germinating in spring. Frequently it will happen that in May an entire pond is covered with the young plants which choke out the water-lilies. Though it might be supposed that if at this time the plants were gathered with a dipnet and destroyed, it would tend to overcome the evil, this is not so. Unfortunately new plants appear on the surface and repeated gathering of these plants only will overcome the trouble. The proportion of their cost to their advantage is far too great to allow them to be introduced in natural ponds.

ADJUNCT PLANTS GROWN FOR THEIR LEAVES

Bear's breech	*Acanthus sp.*
Baneberry	*Actæa alba*
Red baneberry	*Actæa spicata*, var. *rubra*
Hercules' club	*Aralia spinosa*
Giant reed	*Arundo Donax*

Plume poppy	*Bocconia cordata*
Gunnera	*Gunnera manicata* and *G. scabra*
Jointweed	*Polygonum Sacchalinense* and *P. cuspidatum*
Rhubarb	*Rheum sp.*
Saxifrage	*Saxifraga peltata*
Meadow rue	*Thalictrum sp.*
Colt's foot	*Tussilago Farfara*
Arrow arum	*Peltandra Virginica*
False hellebore	*Veratrum album*

SOME ACCESSORY PLANTS OF VARIOUS HEIGHTS

Less than one foot high :	
Water arum	*Calla palustris*
Moneywort	*Lysimachia Nummularia*
Water mint	*Mentha aquatica*
American pennyroyal	*Mentha Pulegium*
Buckbean	*Menyanthes trifoliata*
Forget-me-not	*Myosotis palustris*
Orange milkwort	*Polygala lutea*
Mandrake	*Podophyllum peltatum*
One to two feet high :	
Small flag	*Acorus gramineus*
Marsh marigold	*Caltha palustris*
Golden seal	*Hydrastis Canadensis*
Ground lily	*Trillium grandiflorum*
Two to three feet high :	
Baneberry	*Actæa alba*
Flowering rush	*Butomus umbellatus*
Turtle head	*Chelone sp.*
Bugbane	*Cimicifuga racemosa*
Day lily	*Hemerocallis fulva*
Irises	*Iris spps.*
Loosestrife	*Lysimachia clethroides*
Arrow arum	*Peltandra Virginica*
Arrowhead	*Sagittaria sp.*
Three to four feet high:	
Sweet flag	*Acorus Calamus*
Variegated sweet flag	*Acorus Calamus*, var. *variegatus*

Swamp milkweed	*Asclepias incarnata*
Horsetail	*Equisetum sps.*
Woolly rush	*Eriophorum sps.*
Pampas grass	*Gynerium argenteum*
Gunnera	*Gunnera manicata*
Cardinal flower	*Lobelia cardinalis*
Eulalia	*Miscanthus Sinensis*
Pickerel weed	*Pontederia cordata*

From five feet high or more:

Giant reed	*Arundo Donax*
Papyrus	*Cyperus Papyrus*
Swamp rose mallow	*Hibiscus Moscheutos*
Purple loosestrife	*Lythrum Salicaria*
Cat-tails	*Typha latifolia* and *angustifolia*

Water-lilies for Special Purposes

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CHAPTER XV

Water-lilies for Special Purposes

The following lists are designed to help the amateur in making selections of varieties to suit his own peculiar requirements.

[Editor's Note: No two people will always think alike, and, therefore, there may be some slight differences of opinion about the make-up of some of the following lists, but we believe that they may be accepted as reasonably true for a majority of cases. There is some confusion concerning the names of a few of the water-lilies, and possibly there are totally distinct plants distributed under one name. This is certainly the case with *N. pulcherrima*, a hybrid raised by Mr. Tricker which is recorded by him as being sterile. Other cultivators, on the other hand, say that this water-lily produces seed freely with them. It is known that there are two, probably three,

distinct plants distributed under this title. On the other hand, there is the possibility that hybrids which are sterile in one section of the country may, under other and more favourable conditions, become fertile. These are things about which one cannot yet speak positively. More particular details about each variety will be found in the preceding pages.]

THE MOST FLORIFEROUS

Hardy:

N. alba, var. *candidissima* ..... white
N. W. B. Shaw ..... pink
N. James Brydon ..... red
N. Laydekeri, var. *rosea* ..... small pink
N. Marliacea, var. *chromatella* ..... yellow

Tender:

N. dentata, var. *magnifica* ..... white
N. Omarana ..... magenta — night blooming
N. rubra, var. *rosea* ..... red
N. flavo-virens ..... white
N. William Stone ..... blue — day blooming
N. Mrs. C. W. Ward ..... pink

THE MOST DOUBLE

Hardy:

N. tuberosa, var. *Richardsoni* ..... white
N. James Brydon ..... red
N. Marliacea, var. *chromatella* ..... yellow

Tender:

N. dentata, var. *magnifica* ..... white
N. Sturtevantii ..... pink — night blooming
N. Zanzibariensis ..... blue ... day blooming

FRAGRANT FLOWERED WATER-LILIES

All the tender day bloomers
N. odorata, and varieties
N. odorata rosea and hybrids
N. tetragona

THE BEST RED WATER-LILIES

Tender:

N. gracilis, var. *rubra* ..... day blooming

N. Omarana ..... magenta
N. rubra-rosea ..... largest red
N. Columbiana ..... } deepest color
N. George Huster ..... } deepest color
N. Frank Trelease ..... } deepest color
} night blooming

Hardy:

N. Marliacea, var. *ignea* ..... deepest colour
N. James Brydon ..... strongest plant

THE BEST YELLOW WATER-LILIES

N. Marliacea, var. *chromatella* .....
N. odorata, var. *sulphurea* .....
N. tetragona, var. *helvola* .....
} day blooming

THE BEST WHITE WATER-LILIES

Hardy:

N. alba, var. *candidissima* .....
N. Gladstoniana .....
N. Marliacea, var. *albida* .....
} day blooming

Tender:

N. dentata, var. *grandiflora* ..... night blooming
N. flavo-virens ..... day blooming

THE BEST BLUE WATER-LILIES

Tender:

N. Zanzibariensis ....
N. Pennsylvania .....
N. William Stone .....
} day blooming

WATER-LILIES WITH LARGEST FLOWERS

Hardy:

N. Gladstoniana.....white
N. William Doogue.....pearl

Tender:

N. dentata, var. *magnifica*.....white
N. Omarana.....magenta } night blooming
N. rubra-rosea.....red
N. Zanzibariensis.....deep blue } day blooming
N. gigantea.....light blue

EARLIEST BLOOMING WATER-LILIES

Hardy:

N. alba, var. *candidissima*.....white
N. W. B. Shaw.....pink
N. Marliacea, var. *chromatella*.....yellow
N. James Brydon.....red

WATER-LILIES FOR WINTER FLOWERING

N. Pennsylvania.....blue
N. Zanzibariensis.....blue
N. William Stone.....blue } day blooming
N. Stella Gurney.....pink
N. Mrs. C. W. Ward.....pink
N. dentata.....white } night blooming
N. Devoniensis.....red

WATER LILIES-WITH SMALL SPREAD ON THE WATER

Hardy;

N. odorata, var. *minor*.....white
N. tetragona.....white
N. tetragona, var. *helvola*.....yellow
N. Laydekeri, var. *rosea*.....pink

WATER-LILIES THAT SPREAD SIX FEET OR MORE

Hardy:

N. odorata, var. *gigantea*.....white
N. tuberosa, and varieties.....white and pink

All tender kinds except *N. Mexicana* and *N. elegans*

FOR CUT FLOWERS

Hardy:

N. odorata.....white
N. odorata, var. *rosea*.....pink
N. Marliacea, var. *rosea*.....pink
N. Marliacea, var. *chromatella*.....yellow
N. W. B. Shaw.....pink
N. James Brydon.....red
N. Robinsoni.....red

Tender:

N. rubra, var. *rosea*.....red		night blooming
N. Omarana.....magenta		
N. dentata, and varieties.....white		
N. Pennsylvania.....blue		day blooming
N. William Stone.....blue		
N. Mrs. C. W. Ward.....pink		
N. Stella Gurney.....pink		

SIX RECOMMENDED FOR BEGINNERS

Hardy:

N. Gladstoniana.....white
N. Marliacea, var. *chromatella*.....yellow
N. W. B. Shaw.....pink

Tender:

N. dentata.....white	night blooming
N. Omarana.....magenta	
N. Zanzibariensis.....blue	day blooming

WATER-LILIES THAT SEED THEMSELVES, AND COME TRUE FROM SEED

Hardy:

N. odorata and varieties.....white, etc.

N. alba.....	white
N. candida.....	
N. tetragona.....	
N. tuberosa.....	

N. Mexicana.....yellow

Tender:

N. cærulea	blue	day blooming
N. Capensis	"	
N. Zanzibariensis	"	
N. elegans	"	
N. flavo-virens (*gracilis*)	white	
N. dentata	"	night blooming
N. Lotus	"	
Victoria Cruziana	white, then red	
V. regia	" " "	
Euryale ferox	red	

WATER-LILIES WHICH SEED BUT LITTLE AND CANNOT BE EXPECTED TO BREED TRUE

Hardy:

N. W. B. Shaw	pink
N. Gladstoniana	white
N. odorata, var. *Caroliniana*	pink

Tender:

*N. Omarana**	magenta
N. Sturtevantii	pink
*N. Kewensis**	"
N. Deaniana	"
N. delicatissima	pearl
N. Frank Trelease	crimson
N. Smithiana	"
*N. Jubilee**	"
N. Devoniensis	red
N. rubra, var. *rosea**	"

* Mr. Gurney says these seed liberally at St. Louis

WATER-LILIES THAT NEVER PRODUCE SEED

Hardy:

N. alba, var. *candidissima*

All yellows or yellow tinted, except *N. Mexicana*

All pinks or reds except *N. odorata*, var. *rosea*, and *N. alba*, var. *rubra*

All Marliac and Laydekeri hybrids

Tender:

N. Pennsylvania	blue
N. pulcherrima	"
N. William Stone	"
N. Mrs. C. W. Ward	pink

TENDER WATER-LILIES WHOSE MATURE PLANTS WILL MAKE WINTER TUBERS IN THE CELLAR

N. flavo-virens (*gracilis*)
N. William Stone
N. Mrs. C. W. Ward
N. elegans
— all day bloomers

WATER-LILIES FOR WATER MORE THAN TWO FEET DEEP

Hardy:

N. alba, var. *candidissima*	white
N. odorata, var. *gigantea*	"
N. tuberosa	"
N. Marliacea, var. *albida*	"
N. Marliacea, var. *rosea*	pink
N. Marliacea, var. *carnea*	"

WATER-LILIES FOR WATER LESS THAN ONE FOOT DEEP

Hardy:

N. odorata, var. *minor*	white
N. tetragona	"
N. tetragona, var. *helvola*	yellow
N. Mexicana	"
N. Laydekeri, var. *rosea*	pink
N. Laydekeri, var. *fulgens*	magenta

Tender:

N. Zanzibariensis	blue	day blooming
N. William Stone	"	
N. Mrs. C. W. Ward	pink	

All kinds will do well in one to two feet of water

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